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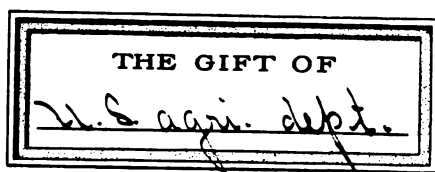
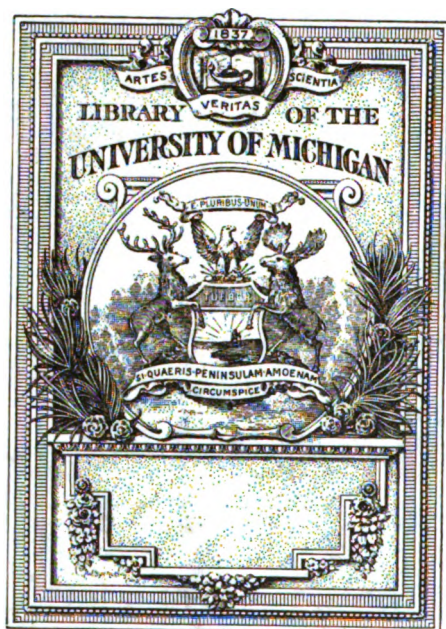
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U. S. DEPARTMENT OF AGRICULTURE.

BUREAU OF ANIMAL INDUSTRY—Bulletin No. 61.

D. E. SALMON, D. V. M., Chief of Bureau.

THE SCORE CARD IN STOCK JUDGING

AT

AGRICULTURAL COLLEGES.

BY

GEORGE M. ROMMEL, B. S. A.,

Expert in Animal Husbandry, Bureau of Animal Industry.



WASHINGTON:
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1904.

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U. S. DEPARTMENT OF AGRICULTURE.

BUREAU OF ANIMAL INDUSTRY—Bulletin No. 61.

D. E. SALMON, D. V. M., Chief of Bureau.

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1904.

LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF ANIMAL INDUSTRY,
Washington, D. C., June 7, 1904.

SIR: I respectfully submit herewith for publication as a bulletin of this Bureau a manuscript entitled "The Score Card in Stock Judging at Agricultural Colleges," compiled by George M. Rommel, expert in animal husbandry. This material was collected during the past year to combine for ready reference the score-card forms used by instructors in animal husbandry throughout the United States.

Nearly all the college cards for market classes in use at present are included in the following pages. Cards for the several breeds were omitted for various reasons, but chiefly because instruction in the judging of market classes and that of breeds is clearly divided; the latter can very well form the nucleus of another similar bulletin.

The charts illustrating the points of the various animals were designed not so much to serve as universal guides for this purpose as to show the location of the parts described by the terms used in the different score cards.

The Bureau is indebted to Prof. Andrew Boss, of the Minnesota School of Agriculture, for the loan of charts used by him in giving instruction in meat production. These charts are submitted for use in this bulletin.

Thanks are also due instructors in animal husbandry in nearly every agricultural college in the country for placing their score cards and other similar material at the disposal of the Bureau.

Respectfully,

D. E. SALMON,
Chief of Bureau

HON. JAMES WILSON,
Secretary of Agriculture.

CONTENTS.

	Page.
Introduction	7
Forms of score cards	8
Horses	10
Light horses	13
Draft horses	26
Mules	39
Beef cattle	40
Store cattle	57
Dairy cattle	58
Hogs	82
Lard hogs	92
Bacon hogs	95
Sheep	97
Mutton sheep	103
Wool sheep	112
Poultry	113
Dressed carcasses and block records:	
Beef cattle	116
Lard hogs	118
Bacon hogs	119
Mutton sheep	119
Animal mechanics:	
Horses	120
Cattle	123
Market reports:	
Beef cattle	124
Efficiency of milking	124

ILLUSTRATIONS.

PLATES.

	Page.
PLATE 1. Diagram of steer, showing Minnesota method of cutting carcass	124
2. Diagram of carcass of beef.....	124
3. Shoulder cut and folded roast	124
4. Small end ribs and large end ribs	124
5. Rolled roast and porterhouse steak	124
6. Sirloin cuts.....	124
7. Round cuts	124
8. Diagram of hog, showing method of cutting carcass.....	124
9. Diagram of carcass of hog with head, shoulders, and hams partly detached	124
10. Shoulders and hams	124
11. Sides and middle.....	124
12. Diagram of sheep.....	124
13. Diagram of carcass of mutton.....	124
14. Shoulders	124
15. Loin, rack, and rib cuts	124
16. Leg of mutton, side and under views	124

TEXT FIGURES.

FIG. 1. Points of the horse	10
2. Points of beef cattle—side view.....	40
3. Points of beef cattle—front and rear views	40
4. Points of the dairy cow—side view	58
5. Points of the dairy cow—three-quarters rear view	58
6. Points of the hog—three-quarters front view	82
7. Points of the hog—side view	82
8. Points of the sheep—side view	97
9. Points of the sheep—front and rear views.....	97
10. Chart for study of proportions of the horse.....	120
11. Chart for study of articular angles of the horse	122

THE SCORE CARD IN STOCK JUDGING AT AGRICULTURAL COLLEGES.

Compiled by GEORGE M. ROMMEL, B. S. A.,
Expert in Animal Husbandry, Bureau of Animal Industry.

INTRODUCTION.

No branch of agricultural college work has developed more rapidly during recent years nor attracted more general attention than the instruction in animal husbandry—the theoretical and practical selection and management of live stock. The immense value of our animal industry (with an estimated annual output of over \$800,000,000), the important relation between live stock and the maintenance of fertility, not to mention the pleasure that attends the successful management of farm animals, have drawn the attention of agricultural educators to this field of work. Indeed, in some instances, the realization of its importance by the agricultural public has had a most telling effect in bringing about proper recognition by the colleges of a previously neglected branch of agriculture.

Instruction in the principles of stock judging demands a very large share of the teacher's time. The aim of the colleges in this work is not to graduate men who are fully equipped to perform the duties of a judge in a show ring, but to give instruction in fundamental principles on which the student, as years give experience, can build an accurate and extensive knowledge of animal form.

The place of the score card in this scheme is important. As an aid to the judge in the show ring, its use is practically obsolete, except in the case of poultry. It is very easy for a competent judge to "score" two animals by the card and reach results directly opposite to what he would have done had the ring been judged by the show-yard system. When thirty or forty animals confront him, no judge would now think of using a score card. However, to learn the cardinal points of form and action and to develop systematic methods, there is no more convenient or expeditious manual than a concise and accurate card.

The first essential in such instruction is to lead the beginner to see correctly—to know what faults or merits each point of the animal presents to the eye or touch. For example, the accepted standards demand that a horse shall have a lean, straight head, of moderate length, with neat, smartly carried ears of moderate size; a broad, full forehead; large, prominent, intelligent, clear eyes; and a fine muzzle, with large nostrils and firm, even lips. It is necessary that the student learn what is therefore an unwritten part of such work.

Following this first step the student learns the comparative value of the different points. For example, he is taught that it is more important, commercially, that a horse shall have a wide, deep, straight, clean hock than a straight, clean head; and he is shown that one of these points has a value of eight or ten on the card, while the other is given one or two. He learns that if a fat steer is thick and even in the covering of the back, he can overlook a little spareness of flesh on the lower rib or a slight lack of development of either flank. In short, he learns what parts in the equine anatomy are most essential to the actual usefulness of a horse, and what parts of a meat-bearing animal bring the highest prices on the block.

When this step is taken many of the colleges give their students work that is little different from that of the show ring. Three or four animals are placed before the student and he is required to place them according to individual merit, writing his reasons on blanks provided for the purpose. No score cards are used, but the student is held as closely as possible to the use of score-card terms. When this stage is reached successfully the cards are dispensed with and the student is supposed to know what is required in the ideal animal. Here the training of the judgment begins, for which college work is really only the preparation. In some cases the score cards are eliminated gradually by requiring the student to assign his reasons point by point before he assigns general reasons for his decisions. This has an advantage in that it is made difficult to overlook any essential features.

The score card, therefore, is only for instruction in fundamentals, and, while in itself it is impracticable for use in the show yard, these fundamentals form the basis for all competent judging.

FORMS OF SCORE CARDS.

The forms of cards used by different instructors naturally vary considerably. Some institutions, for example, use but one card for both draft and light horses. The description is practically the same for both types, and differences are noted in the text. The different standards are provided for by two columns of "points." This system is seen in the cards for horses used by the New Hampshire College,

Cornell University, the North Carolina College, and the Ohio State University, and in the cards for sheep used by the New Hampshire and North Carolina colleges, Purdue University, and the Utah Agricultural College. Its advantages are that it permits the student to get a clear idea of the essentials of each type by comparison, and gives him an idea of animal form in the abstract. Its disadvantages are that a sufficient amount of explanation of differences is not possible, and there is apt to be confusion of types. The more commonly accepted system is a separate card for each type, no matter how close the resemblance.

Generally, the score cards have blanks for the date, name of student, and designation of the animal. In some, space is provided for the age, name of owner, sex, etc.

Several colleges have adopted the plan of numbering the points of the card consecutively. These numbers refer to a blank on which spaces are provided for the score by the student and the instructor. The principal advantage of the blank is that it enables the student to make notes of deficient points.

In some institutions, the cards for each class of animals are printed on the inside covers of a stiff cardboard folder, into which are inserted a number of these blanks. The student thus has his guide and notebook under one cover, and also has the advantage of having a permanent form of card. The University of Tennessee uses a stiff leather-bound folder. On one side is a pocket in which the score cards are placed, and a slot is cut into the other cover into which is slipped the cardboard back of a pad of blanks, the book thus holding the score cards for each class of stock and also the notebook for the class work. It has the advantage over other forms in that one book only is necessary.

Several minor changes have been made in the wording and punctuation of the various cards for the sake of uniformity. Values and definitions, however, are exactly as furnished by the colleges in all cases.

Acknowledgments are due the instructors who supplied these cards for the courtesy.

The score cards now in use follow.

HORSES.

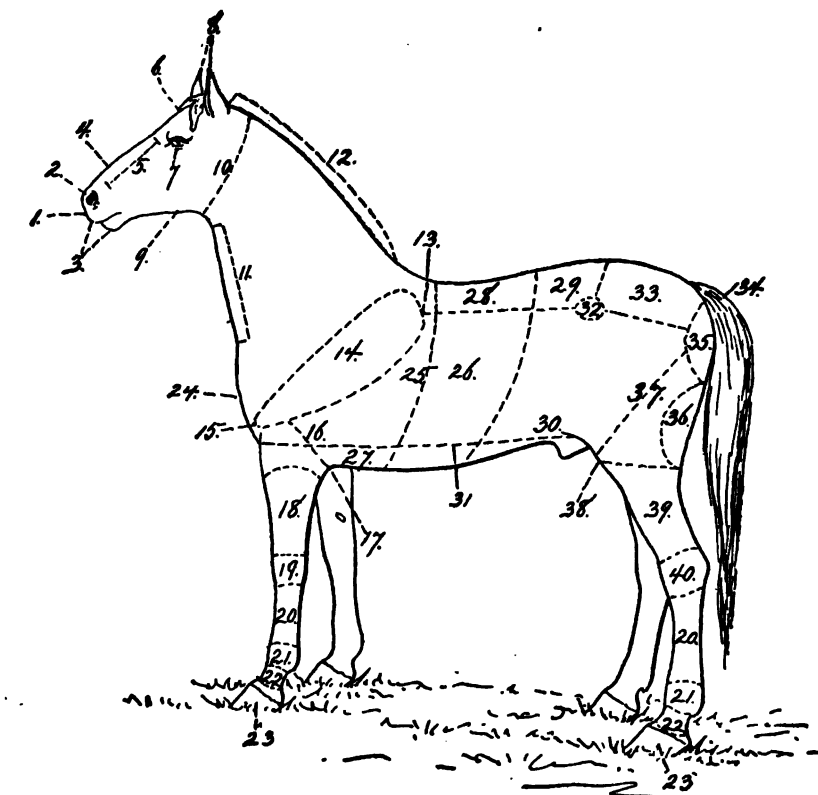


FIG. 1.—Points of the horse.

- | | | | |
|--|---------------------------|----------------------|-------------------------|
| 1. Muzzle. | 11. Windpipe. | 22. Pasterns. | 33. Croup, or rump. |
| 2. Nostril. | 12. Crest. | 23. Feet. | 34. Tail. |
| 3. Lips. | 13. Withers. | 24. Breast. | 35. Buttock. |
| 4. Nose. | 14. Shoulder. | 25. Girth. | 36. Quarter. |
| 5. Face. | 15. Point of shoulder. | 26. Barrel, or ribs. | 37. Thigh. |
| 6. Forehead. | 16. Arm. | 27. Fore flank. | 38. Stifle joint. |
| 7. Eye. | 17. Elbow or elbow joint. | 28. Back. | 39. Gaskin, lower thigh |
| 8. Ears. | 18. Forearm. | 29. Loin. | stifle, or leg. |
| 9. Angle of lower jaw. | 19. Knee. | 30. Hind flank. | 40. Hock. |
| 10. Throatlatch, throat,
or throttle. | 20. Cannons. | 31. Under line. | |
| | 21. Fetlocks. | 32. Hip. | |

New Hampshire College of Agriculture and the Mechanic Arts.

Same as Cornell card (see below) for horses, with the following exceptions: Under neck, the clause beginning "depth of insertion," etc., is omitted; under pasterns, read "6 to 7 inches;" for horses for speed, 8 points are allowed for fore feet and 6 for action.

Cornell University.

Scale of points.	For force.			For speed.		
	Standard.	Student's.	Corrected.	Standard.	Student's.	Corrected.
A. General appearance:						
Height, estimated — hands; actual — hands.....	8			8		
Weight, estimated — pounds; actual — pounds.....	8					
Form, for force, low, massive; for speed, high, lithe.....	6			2		
Quality, bone flat; tendons lean; skin and hair fine.....	8			10		
Action, step smooth, quick, long; trot rapid, straight, regular.....	4			8		
Attitude, members vertical.....	5			5		
Temperament, lively, pleasant.....	4			6		
B. Head and neck:						
Head, lean; length two-fifths height of withers; width of forehead more than one-third length of head; depth of head one-half its length; for S., smaller, carried higher, more horizontal.....	1			2		
Muzzle, fine; nostrils large; lips thin.....	1			1		
Eyes, full, bright, intelligent.....	1			1		
Ears, short, clean, fine, directed forward, wide apart.....	1			1		
Neck, pyramidal, muscled; throat clean, fine; windpipe large; depth of insertion at shoulder equals length of underline, 2 to 4 inches shorter than head; for F., neck shorter, thicker, more horizontal.....	1			2		
C. Fore quarters:						
Shoulders, long, extending into back; point of shoulder to point of withers, equals length of head; for F., shorter more upright.....	3			2		
Arms, relatively short, 12 to 13 inches; for F., more horizontal.....	1			1		
Forearms, vertical, long, 14 to 15 inches wide; for F., shorter, more heavily muscled.....	3			3		
Knees, clean cut, wide, deep, 2 inches, strongly supported.....	2			2		
Cannons, vertical, short, 9 to 10 inches, lean, wide; tendons well detached; for S., longer.....	2			2		
Fetlocks, wide, thick, clean.....	1			1		
Pasterns, fetlock to ground, 7 to 8 inches; for S., long, sloping; for F., short, more upright.....	1			1		
Feet, round, even size; horn dark colored, dense; sole concave; bars strong; frog large, elastic; heel vertical, one-half length of toe.....	6			6		
D. Body:						
Chest in general, high, wide, long; more than half height of horse; for F., girth larger.....	6			4		
Withers, clearly defined for S.....	0			1		
Breast, for S., high, projecting; for F., broad, muscular.....	2			1		
Ribs, long, round curvature, wide apart.....	2			1		
Back, straight, short, muscular; shoulders to haunch equals length of head; for S., longer.....	3			1		
Loin, wide, short, thick.....	2			1		
Flank, narrow, low.....	1			1		
E. Hind quarters:						
Croup, wide, long, muscular, 2 to 4 inches shorter than head; for S., horizontal; for F., shorter, more oblique.....	5			5		
Tail, long, full, fine, set and carried high.....	1			1		
Thighs, for S., long, 15 to 16 inches, upright; stifle deviated outward; for F., shorter, more horizontal, muscular.....	4			6		
Buttocks, heavily muscled, well descended.....	2					
Legs, for S., long, 14 to 15 inches, upright; for F., shorter, more horizontal, heavily muscled.....	3			3		
Hocks, clean cut, large, straight, 3 to 3½ inches deep; for F., wider.....	4			4		
Cannons, 11 to 12 inches, otherwise as above.....	2			2		
Fetlocks, as above.....	1			1		
Pasterns, as above.....	1			1		
Feet, compared with above, more oval, more concave; heels higher, more separated; walls more vertical.....	2			2		
Total.....						

North Carolina College of Agriculture and Mechanic Arts.

Same as Cornell card (see above) for horses, with the following exceptions: Under pasterns, read "6 to 7 inches;" under thighs, read "15 to 17 inches;" for horses for speed, 1 point is allowed for neck, 2 for arm, 8 for fore feet, and 6 for action.

The College of Agriculture and Domestic Science, Ohio State University.

Scale of points.	For force.			For speed.		
	Standard.	Student's.	Corrected.	Standard.	Student's.	Corrected.
A. General appearance:						
Height, estimated — hands; actual — hands	8			8		
Weight, estimated — pounds; actual — pounds	8			2		
Form, for force, low, massive; for speed, high, lithe	6			2		
Quality, bone flat; tendons lean; skin and hair fine	8			10		
Action, step smooth, quick, long; trot rapid, straight, regular	10			15		
Attitude, members vertical	5			5		
Temperament, lively, pleasant	3			6		
B. Head and neck:						
Head, lean; length two-fifths height of withers; width of forehead more than one-third length of head; depth of head one-half its length; for S., smaller, carried higher, more horizontal	2			3		
Muzzle, fine; nostrils large; lips thin	1			1		
Eyes, full, bright, intelligent	1			2		
Ears, short, clean, fine, directed forward, wide apart	1			1		
Neck, pyramidal, muscled; throat clean, fine; windpipe large; depth of insertion at shoulder equals length of underline, 2 to 4 inches shorter than head; for F., neck, shorter, thicker, more horizontal	2			3		
C. Fore quarters:						
Shoulders, long, extending into back; point of shoulder to point of withers equals length of head; for F., shorter, more upright	3			2		
Arms, relatively short, 12 to 13 inches; for F., more horizontal	1			1		
Forearms, vertical, long, 14 to 15 inches, wide; for F., shorter, more heavily muscled	3			2		
Knees, clean cut, wide, deep, 2 inches, strongly supported	1			1		
Cannons, vertical, short, 9 to 10 inches, lean, wide; tendons well detached; for S., longer	2			2		
Fetlocks, wide, thick, clean	1			1		
Pasterns, fetlock to ground, 6 to 7 inches; for S., long, sloping; for F., short, more upright	1			1		
Feet, round, even size; horn dark colored, dense; sole concave; bars strong; frog large, elastic; heel vertical one-half length of toe	5			6		
D. Body:						
Chest in general, high, wide, long; more than half height of horse; for F., girth larger	5			4		
Withers, clearly defined for S.	0			1		
Breast, for S., high, projecting; for F., broad, muscular	2			1		
Ribs, long; round curvature, wide apart	2			1		
Back, straight, short, muscular; shoulders to haunch equals length of head; for S., longer	3			1		
Loin, wide, short, thick	2			1		
Flank, narrow, low	1			1		
E. Hind quarters:						
Croup, wide, long, muscular, 2 to 4 inches shorter than head; for S., horizontal; for F., shorter, more oblique	4			4		
Tail, set and carried high, long, full, fine	1			1		
Thighs, for S., long, 15 to 16 inches, upright; stifle deviated outward; for F., shorter, more horizontal, muscular	3			3		
Buttocks, heavily muscled, well descended	2			1		
Legs, for S., long, 14 to 15 inches, upright; for F., shorter, more horizontal, heavily muscled	2			1		
Hocks, clean cut, large, straight, 3 to 3½ inches deep; for F., wider	4			4		
Cannons, 11 to 12 inches, otherwise as above	1			1		
Fetlocks, as above	1			1		
Pasterns, as above	1			1		
Feet, compared with above, more oval, more concave; heels higher, more separated; walls more vertical	2			2		
Total						

LIGHT HORSES.

College of Agriculture of the University of Illinois.

Scale of points.	Perfect score.	Student's score.	Corrected.
Age, estimated, —; actual, —			
General appearance—13 points:			
1. Weight, estimated — pounds; actual, — pounds			
2. Height, estimated — hands; actual, — hands	2		
3. Form, type, —; symmetrical, smooth, stylish	4		
4. Quality, bone clean, firm, indicating sufficient substance; tendons defined; hair and skin fine	4		
5. Temperament, active; disposition good	3		
Head and neck—7 points:			
6. Head, lean, straight	1		
7. Muzzle, fine; nostril large; lips thin, even; teeth sound	1		
8. Eyes, large, full, bright, clear	1		
9. Forehead, broad, full	1		
10. Ears, size medium; pointed; well carried, not far apart	1		
11. Neck, well muscled; crest high; throatlatch fine; windpipe large	2		
Fore quarters—23 points:			
12. Shoulder, long, smooth with muscle, oblique, extending into back, well muscled at withers	3		
13. Arm, short, thrown forward	1		
14. Forearm, well muscled, long, wide	2		
15. Knees, clean, wide, straight, deep, strongly supported	2		
16. Cannons, short, wide; sinews, large, set back	2		
17. Fetlocks, wide, straight	1		
18. Pasterns, strong, long, angle with ground 45 degrees	2		
19. Feet, medium, even size; straight; horn dense; frog large, elastic; bars strong; sole concave; heel wide, high	6		
20. Legs	4		
Body—9 points:			
21. Chest, deep, low; girth large	2		
22. Ribs, long, well sprung, close	2		
23. Back, straight, short, broad, well muscled	2		
24. Loins, wide, short, thick	2		
25. Underline, long; flank let down	1		
Hind quarters—30 points:			
26. Hips, smooth, wide, level	2		
27. Croup, long, wide, muscular	2		
28. Tail, attached high, well carried	2		
29. Thighs, long, muscular, spread, open angled	2		
30. Quarters, heavily muscled, deep	2		
31. Gaskins (or lower thighs), long, wide, muscular	2		
32. Hocks, clearly defined, wide, straight	5		
33. Cannons, short, wide; sinews large, set back	2		
34. Fetlocks, wide, straight	1		
35. Pasterns, strong, sloping	2		
36. Feet, size medium, even; straight; horn dense; frog large, elastic; bars strong; sole concave; heel wide, high	4		
37. Legs, viewed from behind, a perpendicular line from the point of the buttock should fall upon the center of the hock, cannon, pastern and foot; from the side, a perpendicular line from the hip joint should fall upon the center of the foot and divide the gaskin in the middle, and a perpendicular line from the point of the buttock should run parallel with the line of the cannon	4		
38. Action, step smooth, long, active; trot rapid, straight, regular, high	18		
Total	100		

Iowa State College of Agriculture and the Mechanic Arts.

Scale of points for gelding.		Perfect score.
1. Age —	.....	.....
General appearance:		
2. Weight, —	.....	.....
3. Height —	.....	.....
4. Form, symmetrical, smooth, stylish	.....	4
5. Quality, bone clean, fine, yet indicating sufficient substance; tendons defined; hair and skin fine	.....	4
6. Temperament, active; disposition good	.....	4
Head and neck:		
7. Head, lean, straight	.....	1
8. Muzzle, fine; nostrils large; lips thin, even	.....	1
9. Eyes, full, bright, clear, large	.....	1
10. Forehead, broad, full	.....	1
11. Ears, size medium; pointed, well carried, not far apart	.....	1
12. Neck, muscled; crest high; throatlatch fine; windpipe large	.....	1
Fore quarters:		
13. Shoulders, long, smooth with muscle, oblique, extending into back, muscled at withers	.....	3
14. Arm, short, thrown forward	.....	1
15. Forearm, muscled, long, wide	.....	2
16. Knees, clean, wide, straight, deep, strongly supported	.....	2
17. Cannons, short, wide; sinews large, set back	.....	2
18. Fetlocks, wide, straight	.....	1
19. Pasterns, strong, angle with ground 45 degrees	.....	3
20. Feet, size medium; even, straight; horn dense; frog large, elastic; bars strong; sole concave; heel wide, high	.....	6
21. Legs, viewed in front, a perpendicular line from the point of the shoulder should fall upon the center of the knee, cannon, pastern, and foot; from the side, a perpendicular line dropping from the center of the elbow joint should fall upon the center of the knee and pastern joints and back of hoof	.....	4
Body:		
22. Chest, deep, low; girth large	.....	2
23. Ribs, long, sprung, close	.....	2
24. Back, straight, short, broad, muscled	.....	2
25. Loin, wide, short, thick	.....	2
26. Underline, long; flank let down	.....	1
Hind quarters:		
27. Hips, smooth, wide, level	.....	2
28. Croup, long, wide, muscular	.....	2
29. Tail, attached high, well carried	.....	1
30. Thighs, long, muscular, spread, open angled	.....	2
31. Quarters, heavily muscled, deep	.....	2
32. Gaskins (or lower thighs), long, wide, muscular	.....	2
33. Hocks, clearly defined, wide, straight	.....	5
34. Cannons, short, wide; sinews large, set back	.....	2
35. Fetlocks, wide, straight	.....	1
36. Pasterns, strong, sloping	.....	2
37. Feet, size medium, even; straight; horn dense; frog large, elastic; bars strong; sole concave; heel wide, high	.....	4
38. Legs, viewed from behind, a perpendicular line from the point of the buttock should fall upon the center of the hock, cannon, pastern, and foot; from the side, a perpendicular line from the hip joint should fall upon the center of the foot and divide the gaskin in the middle; and a perpendicular line from the point of the buttock should run parallel with the line of the cannon	.....	4
Action:		
39. Walk, elastic, quick, balanced	.....	5
40. Trot, rapid, straight, regular, high	.....	15
Total	.....	100

Kansas State Agricultural College.

Same as Kentucky card for light horses. (See p. 15.)

Agricultural and Mechanical College of Kentucky.

Scale of points for gelding.	Perfect score.	Student's score.
General appearance:		
Form, symmetrical, smooth, stylish	4	.....
Quality, bone clean, firm, indicating sufficient substance; tendons defined; hair and skin fine	4	.....
Temperament, active, disposition kind	4	.....
Head and neck:		
Head, lean, straight	1	.....
Muzzle, fine; nostrils large; lips thin, even; teeth sound	1	.....
Eyes, full, bright, clear, large	1	.....
Forehead, broad, full	1	.....
Ears, size medium, pointed, well carried, not far apart	1	.....
Neck, muscled; crest high; throatlatch fine; windpipe large	1	.....
Fore quarters:		
Shoulders, long, smooth with muscle, oblique, extending into back	2	.....
Arms, short, thrown forward	1	.....
Forearms, muscled, long, wide	2	.....
Knees, clean, wide, straight, deep, strongly supported	2	.....
Cannons, short, wide; sinews large, set back	2	.....
Fetlocks, wide, straight	1	.....
Pasterns, strong, angle with ground 45 degrees	3	.....
Feet, size medium, even, straight; horn dense; frog large, elastic; bars strong; sole concave; heel wide	6	.....
Legs, viewed in front, a perpendicular line from the point of the shoulder should fall upon the center of the knee, cannon, pastern, and foot; from the side, a perpendicular line dropping from the center of the elbow joint should fall upon the center of the knee and pastern joints and back of hoof	4	.....
Body:		
Withers, muscled, well finished at top	1	.....
Chest, deep, low; girth large	2	.....
Ribs, long, sprung, close	2	.....
Back, straight, short, broad, muscled	2	.....
Loin, wide, short, thick	2	.....
Underline, long; flank let down	1	.....
Hind quarters:		
Hips, smooth, wide, level	2	.....
Croup, long, wide, muscular	2	.....
Tail, attached high, well carried	1	.....
Thighs, long, muscular, spread, open angled	2	.....
Quarters, heavily muscled, deep	2	.....
Gaskins (or lower thighs), long, wide, muscular	2	.....
Hocks, clearly defined, wide, straight	5	.....
Cannons, short, wide; sinews large, set back	2	.....
Fetlocks, wide, straight	1	.....
Pasterns, strong, sloping	2	.....
Feet, size medium, even; straight; horn dense; frog large, elastic; bars strong; sole concave; heel wide, high	4	.....
Legs, viewed from behind, a perpendicular line from the point of the buttock should fall upon the center of the hock, cannon, pastern, and foot; from the side, a perpendicular line from the hip joint should fall upon the center of the foot and divide the gaskin in the middle; and a perpendicular line from the point of the buttock should run parallel with the line of the cannon	4	.....
Action:		
Walk, elastic, quick, balanced	5	.....
Trot, rapid, straight, regular, high	15	.....
Total	100	.....

Maryland Agricultural College.

Scale of points, _____ (sex.)	Perfect score.	Student's score.	Corrected.
General characters:			
Age, student's estimate, —; corrected, —.....	1		
Height, estimated, — hands; actual, — hands.....	2		
Weight, estimated, — pounds; actual, — pounds.....	1		
Form, type, —; symmetrical, smooth, stylish.....	2		
Quality, bone clean; tendons defined; hair and skin fine.....	4		
Temperament, energetic; disposition good.....	8		
	18		
Head and neck:			
Head, lean, straight, shapely.....	1		
Muzzle, fine; nostril large; lips thin.....	1		
Eyes, full, large, bright, clear.....	1		
Forehead, broad, full, flat.....	1		
Ears, size medium, pointed, well carried.....	1		
Neck, muscled, crest high; windpipe large; throatlatch fine.....	1		
	6		
Body:			
Withers, muscled.....	1		
Chest, deep, low; girth large.....	2		
Ribs, long, well sprung, close.....	1		
Back, straight, short, broad, muscled.....	1		
Loins, wide, short, thick.....	1		
Underline, long; flank low.....	1		
	7		
Extremities:			
Shoulder, long, smooth, oblique, extending into back.....	3		
Arm, short, thrown back.....	1		
Forearm, muscled, long, wide.....	1		
Knees, clean, wide, straight, deep, strongly supported.....	2		
Hips, smooth, wide, level.....	2		
Croup, long, wide, muscular, level.....	2		
Thighs, long, muscular, spread, open angled.....	2		
Quarters, heavily muscled, deep.....	2		
Gaskins, long, wide, muscular.....	1		
Hocks, clearly defined, wide, straight.....	6		
Cannon, short, wide; sinews large, set back, flat.....	2		
Fetlocks, wide, straight.....	2		
Pasterns, strong, sloping, medium.....	4		
Fore feet, size medium, even; heel wide, high; frog good; bars strong; sole concave.....	8		
Hind feet, size large, even; heels wide; frogs large.....	6		
	44		
Action, walk smooth, clean, active; trot rapid, straight, even, clean, long, stride.....	25		
Total score.....	100		
Estimated market value.....			

Massachusetts Agricultural College.

Scale of points.	Perfect score.	Points deficient.	
		Student's score.	Corrected.
A. Age —————			
B. General appearance:			
Weight, estimated pounds; actual — pounds			
Height, 16 hands; estimated — hands; actual — hands	2		
Form, type, —; symmetrical, smooth, stylish	4		
Quality, bone clean, firm; tendon defined; hair and skin fine	4		
Action, step smooth, long, active; trot rapid, straight, regular	20		
Temperament, active; disposition good	3		
	33		
C. Head and neck:			
Head, lean, straight	1		
Muzzle, fine; nostril large; lips thin, even; teeth sound	1		
Eyes, full, bright, clear, large	1		
Forehead, broad, full	1		
Ears, size medium, pointed, well carried	1		
Neck, muscled; crest high; throatlatch fine; windpipe large	2		
	7		
D. Fore quarters:			
Shoulder, long, smooth, oblique, extending into back	3		
Arm, short, thrown forward	1		
Forearm, muscled, long, wide	2		
Knees, clean, wide, straight, deep, strongly supported	2		
Cannons, short, wide; sinews large, set back	2		
Fetlocks, wide, straight	1		
Pasterns, strong, angle with ground 45 degrees	2		
Feet, size medium, even; horn dense; frog large; bars strong; sole concave; heel wide, high	6		
	19		
E. Body:			
Withers, muscled	1		
Chest, deep, low; girth large	2		
Ribs, long, sprung, close	2		
Back, straight, short, broad, muscled	2		
Loins, wide, short, thick	2		
Underline, long flank let down	1		
	10		
F. Hind quarters:			
Hips, smooth, wide, level	2		
Croup, long, wide, muscular	2		
Tail, attached high, well carried	1		
Thighs, long, muscular, spread, open angled	2		
Quarters, heavily muscled, deep	3		
Gaskins (or lower thighs), long, wide, muscular	2		
Hocks, clearly defined, wide, straight	8		
Cannons, short, wide; sinews large, set back	2		
Fetlocks, wide, straight	1		
Pasterns, strong, sloping	2		
Feet, medium, even size; horn dense; frog large, elastic; bars strong; sole concave; heels wide, high	6		
	31		
Total	100		
Estimated market value			

College of Agriculture of the University of Minnesota.

Scale of points for gelding.		Perfect score.
1. Age, ———	.....	.....
General appearance:		
2. Weight, ———	.....	4
3. Height, ———	.....	4
4. Form, symmetrical, smooth, stylish	.....	4
5. Quality, bone clean, fine, yet indicating sufficient substance; tendons defined; hair and skin fine	.....	3
6. Temperament, active; disposition good	.....	3
Head and neck:		
7. Head, lean, straight	.....	1
8. Muzzle, fine; nostrils large; lips thin, even	.....	1
9. Eyes, full, bright, clear, large	.....	1
10. Forehead, broad, full	.....	1
11. Ears, size medium; pointed, well carried, not far apart	.....	1
12. Neck, muscled; crest high; throatlatch fine; windpipe large	.....	1
Fore quarters:		
13. Shoulders, long, smooth with muscle, oblique, extending into back, muscled at withers	.....	2
14. Arms, short, thrown forward	.....	1
15. Forearms, muscled, long, wide	.....	2
16. Knees, clean, wide, straight, deep, strongly supported	.....	2
17. Cannons, short, lean; tendons large, set back	.....	2
18. Fetlocks, wide, straight	.....	1
19. Pasterns, strong, angle with ground 45°	.....	3
20. Feet, size medium, even; straight; horn dense; frog large, elastic; bars strong; sole concave; heel wide, high, even	.....	4
21. Legs, viewed from front, a perpendicular line from the point of the shoulders should fall upon the center of the knee, cannon, pastern and foot; from the side, a perpendicular line dropping from the center of the elbow joint should fall upon the center of the knee and pastern joints and back of hoof	.....	4
Body:		
22. Withers, muscled, well finished at the top	.....	1
23. Chest, deep, wide, low; girth large	.....	2
24. Ribs, long, sprung, close	.....	2
25. Back, straight, short, broad, muscled	.....	2
26. Loin, wide, short, thick	.....	2
27. Underline, long; flank let down	.....	1
Hind quarters:		
28. Hips, smooth, wide, level	.....	2
29. Croup, long, wide, muscular	.....	2
30. Tail, attached high, well carried	.....	1
31. Thighs, long, muscular	.....	2
32. Quarters, heavily muscled, deep	.....	2
33. Gaskins (or lower thighs), long, wide, muscled	.....	2
34. Hocks, clean, wide, medium angle	.....	4
35. Cannons, short, wide; tendons large, set back	.....	4
36. Fetlocks, wide, strong	.....	1
37. Pasterns, sloping, strong	.....	2
38. Feet, size medium, even; straight; horn dense; frog large, elastic; bars strong; sole concave; heel wide, high	.....	3
39. Legs, viewed from behind, a perpendicular line from the point of the buttock should fall upon the center of the hock, cannon, pastern and foot; from the side, a perpendicular line from the hip joint should fall upon the center of the foot and divide the gaskin in the middle; and a perpendicular line from the point of the buttock should run parallel with the line of the cannon	.....	4
Action:		
40. Walk, elastic, quick, balanced	.....	3
41. Trot, rapid, straight, regular, high	.....	15
Total	.....	100

College of Agriculture and Mechanic Arts of the University of Missouri.

Scale of points.	Perfect.	Student's score.	Corrected.
General appearance:			
Height, estimated—hands; actual—hands	4		
Weight, estimated—pounds; actual—pounds	4		
Form, symmetrical, smooth, stylish	4		
Quality, bone clean, flat; tendons well defined; skin and hair fine	4		
Action, step smooth, quick, long; trot rapid, straight, regular, high	15		
Temperament, active; disposition kind	4		
Head and neck:			
Head, lean, straight; length two-fifths height of withers; width of forehead more than one-third length of head; depth of head one-half its length	2		
Muzzle, fine; nostrils large; lips thin, even	1		
Eyes, large, full, bright, clear	2		
Forehead, broad, full	1		
Ears, size medium; clean, fine, directed slightly forward, wide apart	1		
Neck, well muscled; crest high; throatlatch clean, fine; wind-pipe large	2		
Fore quarters:			
Shoulders, long, oblique, extending into back; point of shoulder to point of withers equals length of head	2		
Arms, short, thrown forward	1		
Forearms, vertical, long, wide, well muscled	2		
Knees, clean cut, wide, straight, deep, strongly supported	2		
Cannons, vertical, short, lean, wide; tendons well detached	2		
Fetlocks, wide, clean, straight	1		
Pasterns, strong, sloping, angle with ground 45 degrees	2		
Feet, size round, even; horn dark colored, dense; sole concave; bars strong; frog large, elastic; heel wide, vertical, one-half length of toe	4		
Fore legs, viewed in front, a perpendicular line from the point of the shoulder should fall upon the center of the knee, cannon, pastern and foot; from the side a perpendicular line dropping from the center of the elbow joint should fall upon the center of the knee and pastern joints and back of hoof	4		
Body:			
Chest, deep, wide, more than half the height of horse	4		
Withers, clearly defined, well muscled	1		
Ribs, long, well sprung, wide apart	2		
Back, straight, short, broad, muscular	2		
Loin, wide, short, thick	2		
Flank, thin, low	1		
Hind quarters:			
Hips, smooth, wide, level	2		
Croup, long, wide, muscular, somewhat sloping	3		
Tail, attached high, long, full, fine, well carried	1		
Thighs, long, muscular; stifle diverted slightly outward	2		
Buttocks, heavily muscled, well descended	2		
Quarters, heavily muscled, deep	3		
Hock, clearly defined, wide, straight	2		
Cannons, short, wide	2		
Fetlocks, wide, clean, straight	1		
Pastern, strong, sloping	2		
Feet, compared with above, more oval, more concave; heels higher; walls more vertical	4		
Hind legs, viewed from behind, a perpendicular line from the point of the buttock should fall upon the center of the hock, cannon, pastern and foot; from the side, a perpendicular line from the hip joint should fall upon the center of the foot and divide the lower thigh in the middle; and a perpendicular line from the point of the buttock should run parallel with the line of the cannon	4		
Total	100		

North Dakota Agricultural College.

Scale of points for geldings.	Perfect score.	Points deficient.	
		Student's score.	Corrected.
Age, —			
General appearance:			
Weight, — pounds; actual — pounds.			
Height, 16 hands; estimated — hands; actual — hands.	2		
Form, type —; symmetrical, smooth, stylish.	4		
Quality, bone clean, firm; tendons, defined; hair and skin fine.	8		
Temperament, active; disposition good.	5		
Head and neck:			
Head, lean, straight.	1		
Muzzle, fine; nostrils large; lips thin, even; teeth sound.	1		
Eyes, full, bright, clear, large.	1		
Forehead, broad, full.	2		
Ears, size medium; pointed, well carried.	1		
Neck, muscled; crest high; throatlatch fine; windpipe large.	2		
Fore quarters:			
Shoulder, long, smooth, oblique, extending into back.	3		
Arm, short, thrown forward.	1		
Forearm, muscled, long, wide.	2		
Knees, clean, wide, straight, deep, strongly supported.	2		
Cannons, short, wide sinews large, set back.	2		
Fetlocks, wide, straight.	1		
Pasterns, strong, angle with ground 45 degrees.	3		
Feet, size medium, even; horn dense; frog large; bars strong; sole concave; heel wide, high.	8		
Body:			
Chest, deep, low; girth large.	3		
Ribs, long, sprung, close.	2		
Back, straight, short, broad, muscled.	2		
Loins, wide, short, thick.	2		
Underline, long; flank let down.	1		
Hind quarters:			
Hips, smooth, wide, level.	2		
Croup, long, wide, muscular.	2		
Tail, attached high, well carried.	1		
Thighs, long, muscular, spread, open angled.	2		
Quarters, heavily muscled, deep.	3		
Gaskins, (or lower thighs) long, wide, muscular.	2		
Hocks, clearly defined, wide, straight.	8		
Cannons, short, wide; sinews large, set back.	2		
Fetlocks, wide, straight.	1		
Pasterns, strong, sloping.	2		
Feet, size medium, even; horn dense; frog large, elastic; bars strong; sole concave; heel wide, high.	6		
Action, step smooth, long, active; trot rapid, straight, regular.	10		
Total	100		
Estimated market value			

The Pennsylvania State College.

Scale of points.	Perfect score.	Points off.
Eyes, prominent, clear, intelligent, expressive	4	
Objections, sunken small, wild, vicious.		
Head, clean cut; face straight, wide between the eyes; ears medium size, quick; nostrils large, delicate, open; lower jaw clean, strong; muzzle fine.	7	
Objections, thick, coarse, beefy, lacking character and quality; face dishd, too full.		
Neck, symmetrical in length and proportions, graceful; full, arched at crest; clean cut at throttle	4	
Objections, too short; thick at throttle; low at crest.		
Shoulders, flat, strong; oblique, good width and depth	4	
Objections, narrow, too round, too upright.		
Chest, deep, full, expansive	4	
Objections, sunken, narrow, contracted behind elbows.		
Forearm, well formed, strong and muscular for high action	3	
Barrel, deep, moderately well rounded; ribs long, springy; loins strong; back short, strong	4	
Objections, length too great, light, sunken.		
Coupling, smooth, strong, full, close ribbed, extending evenly over the hips.	3	
Objections, long and loose, sunken loin or cut up too high in flank.		
Quarters, symmetrical, muscular, good length, not too sloping, smoothly joined to body	3	
Objections, short, steep.		
Tail, long, full, well set, carried high; quality fine	2	
Objections, set too low, straight, stiff.		
Stiffes and gaskins, muscular, strong, flexible	3	
Hock, sound, clean, good width, strong, without too great an angle, free from meatiness	6	
Objections, narrow, thick, inclined to puff.		
Knees, neither sprung nor calf kneed, broad, straight, strong, relatively high.	6	
Objections, narrow, weak, crooked.		
Cannons, flat, broad, smooth, clean, fine quality yet with abundant substance, moderately long	4	
Objections, short, round, cut in below the knee.		
Pasterns, strong, fair length, sound, clean, sloping	5	
Objections, too short and straight, too long and weak.		
Feet, medium height, straight, squarely set, free from contracted heels; soles and walls tough; frog full, elastic	7	
Objections, narrow, contracted, flat, crooked.		
Color, characteristic of breed	3	
Size, 15 to 16 hands, well proportioned	4	
Coat and skin, hair fine, silky; skin soft, pliable	6	
Objections, coarse, hide bound, staring coat.		
Action, easy, elastic, straight, even, high, showy	10	
Objections, sluggish, ungainly, too low.		
Symmetry and style, well proportioned throughout; position of horse when standing and carriage when in motion attractive, showy, strong	8	
Objections, low headed, lacking in energy, finish, and quality.		
Total	100	

NOTE.—Under the head of "Objections" only a few of the most common are named. Other defects should be scored according to their importance.

South Dakota Agricultural College.

Same as Iowa card for light horses. (See p. 14.)

The Agricultural and Mechanical College of the University of Tennessee.

Scale of points.		Perfect score.	Student score.
A. General appearance:			
1. Weight, 900-1,100 pounds; age, —; color, —	.....	2	.....
2. Height, 16 hands; estimated, — hands; actual, — hands	.....	4	.....
3. Conformation, symmetrical, smooth, stylish	.....	4	.....
4. Quality, bone clean, firm; tendons defined; hair and skin fine	.....	4	.....
5. Action, step smooth, long, active; trot rapid, straight, regular	.....	20	.....
6. Temperament, active; disposition good	.....	3	.....
B. Head and neck:			
7. Head, lean, straight	.....	1	.....
8. Muzzle, fine; nostrils large; lips thin; corresponding teeth sound	.....	1	.....
9. Eyes, full, bright, clear; eyelids oval	.....	1	.....
10. Forehead, broad, full	.....	1	.....
11. Ears, size medium; pointed, well carried	.....	1	.....
12. Neck, muscled; crest high; throatlatch fine; windpipe large	.....	2	.....
C. Fore quarters:			
13. Shoulder, long, smooth, oblique, extending into back	.....	3	.....
14. Arm, short, thrown forward; forearm muscled, long, wide	.....	3	.....
15. Knees, clean, wide, straight, deep, strongly supported; cannons short, wide; tendons large, set back	.....	4	.....
16. Fetlocks, wide, straight; pasterns strong, angle with ground 45 degrees	.....	3	.....
17. Feet, size medium, even; horn dense; sole concave; bars strong; frog prominent, elastic; heels wide, high	.....	5	.....
D. Body:			
18. Withers, muscled	.....	3	.....
19. Chest, deep, low; girth large	.....	3	.....
20. Ribs, long, sprung, close	.....	2	.....
21. Back, straight, short, broad, muscled	.....	2	.....
22. Loins, wide, short, thick	.....	2	.....
23. Underline, long; flank let down	.....	1	.....
E. Hind quarters:			
24. Hips, smooth, wide, level; croup long, wide, muscular	.....	3	.....
25. Tail, attached high, well carried	.....	1	.....
26. Thighs, long, muscular, spread, open angled	.....	2	.....
27. Quarters, heavily muscled, deep	.....	3	.....
28. Gaskin, long, wide, muscular	.....	2	.....
29. Hocks, clearly defined, wide, straight; cannons short, wide; sinews large, set back	.....	0	.....
30. Fetlocks, wide, straight; pasterns strong, sloping	.....	3	.....
31. Feet, size medium, even; horn dense; frog prominent, elastic; bars strong; sole concave; heels wide, high	.....	5	.....
Total	.....	100	.....

Agricultural and Mechanical College of Texas.

Scale of points.		Points deficient.	
(NOTE.—The points as herein described are regarded as constituting perfection. The nature, extent, and importance of the defects presented are thus made apparent by contrast.)		Perfect score, 100.	Student's score.
1. Age.			
2. General appearance—33 points:			
Weight, — pounds; actual, — pounds	1		
Height, 16 hands; estimated, — hands; actual, — hands	2		
Conformation, symmetrical, smooth, stylish	4		
Quality, bone clean, firm; tendons defined; hair and skin fine	4		
Action, step smooth, long, active; trot rapid, straight, regular	20		
Temperament, active; disposition good	3		
3. Head and neck—7 points:			
Head, lean, straight	1		
Muzzle, fine; nostrils large; lips thin, even; teeth sound	1		
Eyes, full, bright, clear, large	1		
Forehead, broad, low	1		
Ears, size medium; pointed, well carried	1		
Neck, muscled; crest high; throatlatch fine; windpipe large	2		
4. Fore quarters—19 points:			
Shoulder, long, smooth, oblique, extending into back	3		
Arm, short, thrown forward	1		
Forearm, muscled, long, wide	2		
Knees, clean, wide, straight, deep, strongly supported	2		
Cannons, short, wide; sinews, large set back	2		
Fetlock, wide, straight	1		
Pasterns strong; angle with ground 45 degrees	2		
Feet, size medium, even; horn dense; bars strong; sole concave; heels wide, high	6		
5. Body—10 points:			
Withers, muscled	1		
Chest, deep, low; girth large	2		
Ribs, long, sprung, close	2		
Back, straight, short, broad, muscled	2		
Loins, wide, short, thick	2		
Underline, long; flank let down	1		
6. Hind quarters—31 points:			
Hips, smooth, wide, level	2		
Croup, long, wide, muscular	2		
Tail, attached high, well carried	1		
Thighs, long, muscular, spread, open angled	2		
Quarters, heavily muscled, deep	3		
Gaskins (or lower thighs), long, wide, muscular	2		
Hocks, clearly defined, wide, straight	3		
Cannons, short, wide; sinews large, set back	2		
Fetlocks, wide, straight	1		
Pasterns, strong, sloping	2		
Feet, size medium, even; horn dense; frog large; bars strong; sole concave; heels wide, high	6		
Total			

Agricultural College of Utah.

Scale of points.	Score.	
	Stand- ard.	Student's. Corrected.
General appearance:		
Age, as indicated by teeth, —		
Weight, estimated, — pounds; actual, — pounds		
Height, 16 hands; estimated, — hands; actual, — hands	2	
Form, type, —, symmetrical, smooth, stylish	4	
Quality, bone clean, firm; tendons defined; hair and skin fine	8	
Action, step smooth, long, active; trot rapid, straight, regular	8	
Temperament, active; disposition good	4	
Head and neck:		
Head, lean; face straight, wide between the eyes	1	
Muzzle, fine; nostrils large; lips thin, even; teeth sound	1	
Eyes, full, bright, clear, large	1	
Forehead, broad, full	1	
Ears, size medium; pointed, well carried	1	
Neck, muscled, symmetrical; crest high; throat clean, fine; windpipe large	3	
Fore quarters:		
Shoulders, long, smooth, oblique, extending into back	3	
Arm, short, thrown forward	1	
Fore arm, muscled, long, wide	2	
Knees, clean, wide in front, straight, deep, strongly supported	2	
Cannons, short, wide on the side; sinews large, set back	2	
Fetlock, wide, straight	1	
Pasterns, strong, fair length, sound, angle with the ground 45 degrees	3	
Feet, size medium, even; straight, squarely set; horn dense; frog large; bars strong; sole concave; heel wide, high	8	
Body:		
Withers, muscled	1	
Chest, deep, low; girth large, — feet, — inches	3	
Ribs, long, sprung, close	2	
Back, straight, short, broad, muscled	2	
Loin, wide, short, thick	2	
Underline, long; flank let down	1	
Hind quarters:		
Hips, smooth, wide, level	2	
Croup, long, wide, muscular	2	
Tail, attached high, well carried	1	
Thighs, long, muscular, spread, open angled	2	
Quarters, heavily muscled, deep, broad	3	
Gaskins (or lower thighs), long, wide, muscular	2	
Hocks, clearly defined, wide from side and in front, muscular, not too great an angle	8	
Cannons, short, wide; sinews large, set back	2	
Fetlocks, wide, straight	1	
Pasterns, strong, sloping	2	
Feet, medium, even size; horn dense; frog large, elastic; bars strong; sole concave; heels wide, high	6	
Total	98	
Estimated market value		

Agricultural College of the University of Wisconsin.

Scale of points.	Possible score.	Points deficient.	
		Student's score.	Corrected.
Age. —			
General appearance—28 points:			
Weight, — pounds; actual — pounds			
Height, estimated, — hands; actual, — hands	2		
Form, type —; symmetrical, smooth, stylish	4		
Quality, bone clean, fine; tendons well defined; hair and skin fine	4		
Action, step smooth, long, active; trot rapid, straight, regular	15		
Temperament, active; disposition good	3		
Head and neck—11 points:			
Head, not too large, features well defined, regular	2		
Muzzle, fine; nostrils large, flexible; lips thin, even	1		
Eyes, full, bright, clear, large	2		
Forehead, broad, full	1		
Ears, size medium; pointed, well carried	1		
Lower jaw, angles wide; space clean	1		
Neck, muscled, arched; throatlatch fine; windpipe large	3		
Fore quarters—20 points:			
Shoulder, long, smooth, oblique, extending into back	3		
Arm, short, well muscled, thrown forward, well under the body	1		
Forearm, well muscled, long, wide	2		
Knees, clean, wide, straight, deep, strongly supported	2		
Cannons, short, clean; tendons large, hard, set well back	2		
Fetlocks, wide, straight, square	1		
Pasterns, strong, lengthy, angle with ground 45 degrees	3		
Feet, size medium, even; horn dense; frog large; bars strong; sole concave; heel wide, not low	6		
Body—10 points:			
Withers, high, extending well back	1		
Chest, deep, low; girth large	2		
Ribs, deep, well sprung, close	2		
Back, straight, short, broad, well muscled	2		
Loins, wide, short, thick	2		
Underline, long; flank narrow above, let well down	1		
Hind quarters—31 points:			
Hips, smooth, wide, level	2		
Croup, long, wide, muscular, not drooping	3		
Tail, attached high, well carried	1		
Thighs, muscular, spread, open angled	3		
Stifles, well muscled	2		
Gaskins (or lower thighs), long, broad, muscular	3		
Hocks, clearly defined, wide, straight, deep	7		
Cannons, short, wide; tendons large, hard, set well back	2		
Fetlocks, wide, straight, square	1		
Pasterns, strong, oblique, springy	3		
Feet, size medium, even; horn dense; frog large, elastic; bars strong; sole concave; heels wide	4		
Total	100		
Estimated market value			

DRAFT HORSES.

The State Agricultural College of Colorado.

Scale of points for gelding.	Perfect score.	Parts deficient.	
		Student's score.	Corrected.
Age, —			
General appearance:			
Height, estimated, — hands; actual, — hands			
Weight, over 1,500 pounds; estimated — pounds; score according to age	4		
Form, broad, massive, proportioned	4		
Quality, bone smooth, hard; tendons lean; skin and hair fine	4		
Temperament, energetic; disposition good	4		
Head and neck:			
Head, lean; size medium	1		
Muzzle, fine; nostrils large; lips thin, even	1		
Eyes, full, bright, clear	1		
Forehead, broad, full	1		
Ears, size medium; well carried	1		
Neck, muscled; crest high; throat latch fine; windpipe large	1		
Fore quarters:			
Shoulder, sloping, smooth, snug, extending into back	2		
Arm, short, thrown back	1		
Forearm, heavily muscled, long, wide	2		
Knees, wide, clean cut, straight, deep, strongly supported	2		
Cannons, short, lean, wide; sinews large, set back	2		
Fetlocks, wide, straight, strong	1		
Pasterns, sloping, lengthy, strong	3		
Feet, size large, even; horn dense; sole concave; bars strong; frog large, elastic; heel wide, one-half length of toe and vertical to ground	8		
Legs, viewed in front, a perpendicular line from the point of the shoulder should fall upon the center of the knee, cannon, pastern, and foot; from the side, a perpendicular line dropping from the center of the elbow joint should fall upon the center of the knee and pastern joints and back of hoof	4		
Body:			
Chest, deep, wide, low; girth large	2		
Ribs, long, close, sprung	2		
Back, straight, short, broad, muscular	2		
Loins, wide, short, thick, straight	2		
Underline, flank low	1		
Hind quarters:			
Hips, smooth, wide	2		
Croup, wide, muscular	2		
Tail, attached high, well carried	1		
Thighs, muscular	2		
Quarters, deep, heavily muscled	2		
Gaskins (or lower thighs), wide, muscled	2		
Hocks, clean cut, wide, straight	8		
Cannons, short, wide; sinews large, set back	2		
Fetlocks, wide, straight, strong	1		
Pasterns, sloping, strong, lengthy	2		
Feet, size large, even; horn dense; dark color; sole concave; bars strong; frog large, elastic; heel wide, one-half length of toe and vertical to ground	6		
Legs, viewed from behind, a perpendicular line from the point of the buttock should fall upon the center of the hock, cannon, pastern, and foot; from the side, a perpendicular line from the hip joint should fall upon the center of the foot and divide the gaskin in the middle, and a perpendicular line from the point of the buttock should run parallel with the line of the cannon.	4		
Action:			
Walk, smooth, quick, long, balanced	6		
Trot, rapid, straight, regular	4		
Total	100		

College of Agriculture of the University of Illinois.

Scale of points.	Perfect score.	Student's score.	Corrected.
Age, estimated, —; actual, —			
General appearance—22 points:			
1. Height, estimated, — hands; actual, — hands			
2. Weight, over 1,600 pounds; estimated, — pounds; actual, — pounds; score according to age	6		
3. Form, broad, massive, proportioned	4		
4. Quality, bone smooth, hard; tendons lean; skin and hair fine	8		
5. Temperament, energetic; disposition good	4		
Head and neck—8 points:			
6. Head, lean; size medium	2		
7. Muzzle, fine; nostril large; lips thin, even	1		
8. Eyes, large, full, bright, clear	2		
9. Forehead, broad, full	1		
10. Ears, size medium; well carried	1		
11. Neck, muscled; crest high; throatlatch fine; windpipe large	1		
Fore quarters—22 points:			
12. Shoulders, sloping, smooth, snug, extending into back	3		
13. Arm, short	1		
14. Forearm, heavily muscled, long, wide	2		
15. Knees, wide, clean cut, straight, deep, strongly supported	2		
16. Cannons, short, lean, wide; sinews large, set back	2		
17. Pasterns, moderately sloping, medium length, strong; fetlocks wide, straight	2		
18. Feet, size large, even; horn dense; sole concave; bars strong; frog large, elastic; heel wide, one-half length of toe and vertical to ground	6		
19. Legs, viewed in front, a perpendicular line from the point of the shoulder should fall upon the center of the knee, cannon, pastern, and foot; from the side, a perpendicular line dropping from the center of the elbow joint should fall upon the center of the knee and pastern joints and back of hoof	4		
Body—9 points:			
20. Chest, deep, wide, low; girth large	2		
21. Ribs, long, close, sprung	2		
22. Back, straight, short, broad, muscular	2		
23. Loins, wide, short, thick, straight	2		
24. Underline, flank low	1		
Hind quarters—29 points:			
25. Hips, smooth, wide	2		
26. Croup, long, wide, muscular	2		
27. Tail, attached high, well carried	1		
28. Quarters, deep, heavily muscled, thighs muscular	4		
29. Gaskins (or lower thighs), wide, well muscled	2		
30. Hocks, clean cut, wide, straight	6		
31. Cannons, short, wide; sinews large, set back	2		
32. Pasterns, moderately sloping, strong, medium length; fetlocks wide, straight	2		
33. Feet, size large, even; horn dense; sole concave; bars strong; frog large, elastic; heel wide, one-half length of toe and vertical to ground	4		
34. Legs, viewed from behind, a perpendicular line from the point of the buttock should fall upon the center of the hock, cannon, pastern, and foot; from the side, a perpendicular line from the hip joint should fall upon the center of the foot and divide the gaskin in the middle; and a perpendicular line from the point of the buttock should run parallel with the line of the cannon	4		
Action—10 points:			
35. Walk, smooth, quick, long, balanced	6		
36. Trot, rapid, straight	4		
Total	100		

School of Agriculture of Purdue University.

Same as the Illinois card (see p. 27) for draft horses, with the following exceptions: Under arm, read "short, thrown back;" under pastern, read "sloping, lengthy, strong; fetlocks wide, straight;" under gaskins, read "wide, muscled;" under hind pasterns, read "sloping, lengthy; fetlocks wide, straight;" under action, read "trot rapid, straight, regular."

Iowa State College of Agriculture and the Mechanic Arts.

Scale of points for gelding.		Perfect score.
1. Age —		
General appearance:		
2. Height — hands		
3. Weight, over 1,500 pounds, — pounds; score according to age		4
4. Form, broad, massive, low set, proportioned		4
5. Quality, bone clean, yet indicating sufficient substance; tendons distinct; skin and hair fine		4
6. Temperament, energetic; disposition good		4
Head and neck:		
7. Head, lean; size medium		1
8. Muzzle, fine; nostrils large; lips thin, even		1
9. Eyes, full, bright, clear, large		1
10. Forehead, broad, full		1
11. Ears, size medium; well carried		1
12. Neck, muscled; crest high; throatlatch fine; windpipe large		1
Fore quarters:		
13. Shoulders, sloping, smooth, snug, extending into back		2
14. Arm, short, thrown forward		1
15. Forearm, heavily muscled, long, wide		2
16. Knees, wide, clean cut, straight, deep, strongly supported		2
17. Cannons, short, lean, wide; sinews large, set back		2
18. Fetlocks, wide, straight, strong		1
19. Pasterns, sloping, lengthy, strong		3
20. Feet, size large, even; straight; horn dense; color dark; sole concave; bars strong; frog large, elastic; heel wide, high, one-half length of toe		8
21. Legs, viewed in front, a perpendicular line from the point of the shoulder should fall upon the center of the knee, cannon, pastern, and foot; from the side, a perpendicular line dropping from the center of the elbow joint should fall upon the center of the knee and pastern joints and back of hoof		4
Body:		
22. Chest, deep, wide, low; girth large		2
23. Ribs, long, close, sprung		2
24. Back, straight, short, broad		2
25. Loin, wide, short, thick, straight		2
26. Underline, flank, low		1
Hind quarters:		
27. Hips, smooth, wide		2
28. Croup, long, wide, muscular		2
29. Tail, attached high, well carried		1
30. Thighs, muscular		2
31. Quarters, deep, heavily muscled		2
32. Gaskins (or lower thighs), wide, muscled		2
33. Hocks, clean cut, wide, straight		8
34. Cannons, short, wide; sinews large, set back		2
35. Fetlocks, wide, straight, strong		1
36. Pasterns, sloping, strong, lengthy		2
37. Feet, size large, even; straight; horn dense, color dark; sole concave; bars strong; frog large, elastic; heel wide, high, one-half length of toe		6
38. Legs, viewed from behind, a perpendicular line from the point of the buttock should fall upon the center of the hock, cannon, pastern, and foot; from the side, a perpendicular line from the hip joint should fall upon the center of the foot and divide the gaskin in the middle; and a perpendicular line from the point of the buttock should run parallel with the line of the cannon		4
Action:		
39. Walk, smooth, quick, long, balanced		6
40. Trot, rapid, straight, regular		4
Total		100

Kansas State Agricultural College.

Same as the Colorado card (see p. 26), with the omission of "age" and "height" and the omission of the term "muscular" under "back."

Maryland Agricultural College.

Scale of points for — (sex).	Perfect score.	Student's score.	Corrected.
General characters:			
Age, student's estimate, —; corrected, —	2		
Height, estimated, — hands; actual, — hands	3		
Weight, 1,500 pounds or over; estimated at — pounds	8		
Form, broad, massive, proportioned	4		
Quality, bones smooth, hard; tendons lean; skin fine	5		
Temperament, energetic; disposition good	8		
	25		
Head and neck:			
Head, lean, shapely; size medium	1		
Muzzle, fine; nostril large, lips thin, even	1		
Eyes, full, bright, clear	1		
Forehead, broad, full, flat	1		
Ears, size medium; carried well	1		
Neck, muscled; crest high; windpipe large; throatlatch fine	2		
	7		
Body:			
Chest, deep, wide, low; girth large	3		
Ribs, long, close, sprung	1		
Back, straight, short, broad, muscular	2		
Loin, wide, short, thick, straight	1		
Underline, flank low	1		
	8		
Extremities:			
Shoulder, sloping, smooth, snug, extending into back	3		
Arm, short, thrown back	1		
Forearm, heavily muscled, long, wide	2		
Knees, wide, clean cut, straight, deep, strongly supported	2		
Hips, smooth, wide, level	3		
Croup, wide, muscular, level	2		
Thighs, muscular	2		
Quarters, deep, heavily muscled	3		
Gaskins, wide, muscled	2		
Hocks, clear cut, wide, straight	8		
Cannon, short, wide; sinews large, set back	2		
Fetlocks, wide, straight, strong	2		
Pasterns, sloping, strong, medium	4		
Forefeet, size large, even; concave; heels wide; frog large	8		
Hind feet, large, even size; heels wide; frogs large	6		
	50		
Action, step smooth, elastic, even, long, quick; trot straight, regular	10		
	100		
Total score			
Estimated market value			

Massachusetts Agricultural College.

Scale of points for gelding.	Perfect score.	Points deficient.	
		Student's score.	Corrected.
Age —			
General appearance:			
Height, estimated, — hands; actual, — hands			
Weight, over 1,500 pounds; estimated, — pounds; score according to age	6		
Form, broad, massive, proportioned	4		
Quality, bone smooth, hard; tendons lean; skin and hair fine	6		
Temperament, energetic; disposition good	5		
	21		
Head and neck:			
Head, lean; size medium	1		
Muzzle, fine; nostril large; lips thin, even	1		
Eyes, full, bright, clear	1		
Forehead, broad, full	1		
Ears, size medium; well carried	1		
Neck, muscled; crest high; throatlatch fine; windpipe large	1		
	6		
Fore quarters:			
Shoulder, sloping, smooth, snug, extending into back	3		
Arm, short, throw back	1		
Forearm, heavily muscled, long, wide	2		
Knees, wide, clean cut, straight, deep, strongly supported	2		
Cannons, short, lean, wide; sinews large, set back	2		
Fetlocks, wide, straight, strong	1		
Pasterns, sloping, lengthy, strong	3		
Feet, size large, even; horn dense; sole concave; bars strong; frog large, elastic; heel wide, one-half length of toe and vertical to ground	8		
	22		
Body:			
Chest, deep, wide, low; girth large	2		
Ribs, long, close sprung	2		
Back, straight, short, broad, muscular	2		
Loins, wide, short, thick, straight	2		
Underline, flank low	1		
	9		
Hind quarters:			
Hips, smooth, wide	2		
Croup, wide, muscular	3		
Thighs, muscular	2		
Quarters, deep, heavily muscled	4		
Gaskins (or lower thighs), wide, muscled	2		
Hocks, clear cut, wide, straight	8		
Cannons, short, wide; sinews large, set back	2		
Fetlocks, wide, straight, strong	1		
Pasterns, sloping, strong, lengthy	2		
Feet, size large, even; horn dense, color dark; sole concave; bars strong; frog large, elastic; heel wide, one-half length of toe and vertical to ground	6		
Action, step smooth, quick, long; trot rapid, straight, regular	10		
	42		
Total	100		
Estimated market value			

Michigan State Agricultural College.

Scale of points.	Perfect.	Student's estimate.	Corrected.
General appearance:			
Age, as indicated by teeth			
Height, estimated, — hands; actual, — hands			
Weight, 1,500 pounds and above	4		
Form, low, square, massive	4		
Quality, bone clean, hard; skin lying close to bone and tendons; hair fine	7		
Temperament, docile, energetic, but not nervous	5		
	20		
Head and neck:			
Head, medium size, lean, intelligent	2		
Muzzle, fine; nostrils wide, open; lips thin, even	1		
Eyes, prominent, bright, clear	1		
Forehead, broad, full	2		
Ears, rather short, but pointed, well carried	2		
Neck, inclined to be short, deep at junction with body; crest high; mane good	2		
	10		
Fore quarter:			
Shoulder, smooth, moderately upright, muscles covering blade well developed	4		
Arm, short, well muscled	3		
Knees, wide, deep, straight, strong	2		
Cannons, short, flat, lean; sinews large	2		
Pasterns, short, strong	3		
Feet, not flat, large; horn dense; frog well developed, elastic; heels wide, full, round	8		
	22		
Body:			
Chest, deep, broad, full; girth large	3		
Back, straight, short, well muscled	2		
Loin, wide, short	2		
Ribs, well sprung, making round barrel	2		
	9		
Hind quarters:			
Hips, smooth, wide apart	2		
Croup, well muscled, wide	2		
Tail, well carried, attached high	1		
Thighs, full, muscular, thick through the hams	2		
Quarters, deep, thoroughly muscled	4		
Gaskins, wide, muscles outstanding	2		
Hocks, short, flat; sinews prominent	7		
Pasterns, short, strong	3		
Feet, not flat, large; horn dense; frog well developed, elastic; heels wide, full, round	8		
Action, step smooth, straight, quick, moderately long	8		
	39		
Total	100		

College of Agriculture of the University of Minnesota.

Scale of points for gelding.		Perfect score.
1. Age		
General appearance:		
2. Height		2
3. Weight, over 1,500 pounds; estimated, — pounds; score according to age		4
4. Form, broad, massive, proportioned		4
5. Quality, bone clean, fine, yet indicating sufficient substance; tendons lean; skin and hair fine		4
6. Temperament, energetic; disposition good		4
Head and neck:		
7. Head, lean; size medium		1
8. Muzzle, fine; nostrils large; lips thin, even		1
9. Eyes, full, bright, clear, large		1
10. Forehead, broad, full		1
11. Ears, size medium; well carried		1
12. Neck, muscled; crest high; throatlatch fine; windpipe large		1
Fore quarters:		
13. Shoulders, moderately sloping, smooth, snug		2
14. Arm, short, thrown forward		1
15. Forearm, heavily muscled, long, wide		2
16. Knees, wide, clean cut, straight, deep, strongly supported		2
17. Cannons, short, wide; tendons large, set back		1
18. Fetlocks, wide, straight, strong		1
19. Pastern, sloping, lengthy, strong		3
20. Feet, size large, even; straight; horn dense; sole concave; bars strong; frog large, elastic; heels wide, high, even		6
21. Legs, viewed in front, a perpendicular line from the point of the shoulder should fall upon the center of the knee, cannon, pastern, and foot; from the side a perpendicular line dropping from the center of the elbow joint should fall upon the center of the knee and pastern joints and back of hoof		4
Body:		
22. Chest, deep, wide, low; girth large		2
23. Ribs, long, sprung, close		2
24. Back, straight, short, broad		2
25. Loin, wide, short, thick, straight		2
26. Underline, flank low		1
Hind quarters:		
27. Hips, smooth, wide		2
28. Croup, long, wide, muscular		2
29. Tail, attached high, well carried		1
30. Thighs, muscular		2
31. Quarters, deep, heavily muscled		2
32. Gaskins (or lower thighs), wide, muscled		2
33. Hocks, clean cut, wide, straight		8
34. Cannons, short, wide; sinews large, set back		2
35. Fetlocks, wide, straight, strong		1
36. Pasterns, sloping, strong, lengthy		2
37. Feet, size large, even; straight; horn dense; color dark; sole concave; bars strong; frog large, elastic; heel wide, high, one-half length of toe		6
38. Legs, viewed from behind, a perpendicular line from the point of the buttock should fall upon the center of the hock, cannon, pastern, and foot; from the side, a perpendicular line from the hip joint should fall upon the center of the foot and divide the gaskin in the middle; and a perpendicular line from the point of the buttock should run parallel with the line of the cannon		4
Action:		
39. Walk, smooth, quick, long, balanced		6
40. Trot, rapid, free, straight, regular		4
Total		100

College of Agriculture and Mechanic Arts, University of Missouri.

Scale of points.	Perfect score.	Students' score.	Corrected.
General appearance:			
Height, estimated, — hands; actual, — hands			
Weight, over 1,500 pounds; estimated, — pounds; actual, — pounds; score according to age	6		
Form, low, massive, well proportioned	6		
Quality—bone clean, flat; tendons lean; skin and hair fine	4		
Temperament, energetic; disposition good	4		
Action—step smooth, quick, long, balanced; trot rapid, straight, regular	10		
Head and neck:			
Head, lean; size medium	2		
Muzzle, fine; nostrils large; lips thin, even	1		
Eyes, full, bright, clear	2		
Forehead, broad, full	1		
Ears, size medium; well carried, wide apart	1		
Neck, well muscled, crest high; throatlatch fine; windpipe large	2		
Fore quarters:			
Shoulders, only slightly sloping, smooth, extending into back	2		
Arms, short, thrown back	1		
Forearms, long, wide, heavy / muscled	2		
Knees, wide, clean cut, straight, strongly supported	2		
Cannons, short, vertical, lean, wide, flat	2		
Fetlocks, wide, straight, strong	1		
Pasterns, sloping, strong, thick; angle with ground 45 degrees	2		
Feet, round; size large, even; horn dense; sole concave; bars strong; frog large, elastic; heel wide, one-half length of toe	6		
Fore legs, viewed in front, a perpendicular line from the point of the shoulder should fall upon the center of the knee, cannon, pastern, and foot; from the side a perpendicular line dropping from the center of the elbow joint should fall upon the center of the knee and pastern joints and back of hoof	1		
Body:			
Chest, deep, wide; girth large	3		
Withers, smooth, not prominent, well muscled	1		
Ribs, long, wide apart, well sprung	2		
Back, short, straight, broad, well muscled	2		
Loins, wide, short, thick	2		
Flank, low	1		
Hind quarters:			
Hips, smooth, wide	2		
Croup, wide, muscular, somewhat oblique	2		
Tail, attached high, full, well carried	1		
Thighs, well muscled	2		
Buttocks, heavily muscled, wide	2		
Quarters, deep, heavily muscled	2		
Hock, wide, straight, clean cut	4		
Cannons, short, wide	2		
Fetlocks, wide, straight, strong	1		
Pasterns, sloping, strong	2		
Hind feet, compared with forefeet, more oval, more concave; heels higher; walls more vertical	4		
Hind legs, viewed from behind, a perpendicular line from the point of the buttock should fall upon the center of the hock, cannon, pastern, and foot; from the side, a perpendicular line from the hip joint should fall upon the center of the foot and divide the lower thigh in the middle, and a perpendicular line from the point of the buttock should run parallel to the line of the cannon	4		
Total	100		

North Dakota Agricultural College.

Scale of points for gelding. ^a	Perfect score.	Points deficient.	
		Student's score.	Corrected.
Age. —			
General appearance:			
Height, estimated, —; actual, —			
Weight, over 1,500 pounds; estimated, — pounds; score according to age	4		
Form, broad, massive, proportioned	4		
Quality, bone smooth, hard; tendons lean; hair and skin fine	8		
Temperament, energetic; disposition good	5		
Head and neck:			
Head, lean; size medium	1		
Muzzle, fine; nostrils large; lips thin, even	1		
Eyes, full, bright, clear	1		
Forehead, broad, full	2		
Ears, size medium; well carried	1		
Neck, muscled; crest high; throatlatch fine; windpipe large	1		
Fore quarters:			
Shoulder, sloping, smooth, snug, extending into back	3		
Arm, short, thrown back	1		
Forearm, heavily muscled, long, wide	2		
Knees, wide, clean-cut, straight, deep, strongly supported	2		
Cannons, short, lean, wide; sinews large, set back	2		
Fetlocks, wide, straight, strong	1		
Pasterns, sloping, lengthy, strong	3		
Feet, size large, even; horn dense; sole concave; bars strong; frog large, elastic; heel wide, one-half length of toe and vertical to ground	8		
Body:			
Chest, deep, wide, low; girth large	2		
Ribs, long, sprung, close	2		
Back, straight, short, broad, muscular	2		
Loin, wide, short, thick, straight	2		
Underline, flank low	1		
Hind quarters:			
Hips, smooth, wide	2		
Croup, wide, muscular	3		
Tail, attached high, well carried	1		
Thighs, muscular	2		
Quarters, heavily muscled, deep	4		
Gaskins (or lower thighs), wide, muscled	2		
Hocks, clear cut, wide, straight	8		
Cannons, short, wide; sinews large, set back	2		
Fetlocks, wide, straight, strong	1		
Pasterns, sloping, strong, lengthy	2		
Feet, size large, even; horn dense; color dark; sole concave; bars strong; frog large, elastic; heel wide, one-half length of toe and vertical to ground	6		
Action, step smooth, quick, long; trot rapid, straight, regular	8		
Total	100		
Estimated market value			

^a After Craig.

Oklahoma Agricultural and Mechanical College.

Same as the Colorado card (see p. 26) for draft horses, with the omission of "age" and "height" and the omission of the term "muscular" under "back." There are also some slight changes in phraseology.

Pennsylvania State College.

Scale of points.	Perfect score.	Points off.
Eyes, prominent, clear, intelligent, expressive	4	
Objections, small, sunken, vicious, wild.		
Head, clean cut; face straight, wide between the eyes; ears of fair size but not sluggish; nostrils large, open; lower jaw strong, clean; lips fine, firm	5	
Objections, narrow, thick, beefy, dish face.		
Neck, symmetrical in length and proportions, strong; full at crest; clean cut at throttle	4	
Objections, too short, thick; low at crest.		
Shoulders, well rounded, muscular, moderately sloping; strong at base; well finished at withers	4	
Objections, lacking in muscle, too upright.		
Chest, deep, full, prominent, with good width	5	
Objections, narrow, sunken.		
Forearm, well formed, well joined, strong, muscular.	4	
Barrel, round, with well sprung ribs and full heart girth; back short, strong	6	
Objections, narrow, ribs too straight.		
Coupling, smooth, strong, full, close ribbed, extending evenly over the point of the hips.	5	
Objections, loose: sunken loin, high flank.		
Quarters, symmetrical, medium length and width, not too sloping, well rounded, muscular	4	
Objections, narrow, too short, too steep.		
Tail, full, well set, fine in quality	1	
Objections, coarse, stiff.		
Stiffes and gaskins, muscular, full, short, strong	4	
Objections, lacking in muscle.		
Hock, sound, wide, strong, without too great an angle and free from meatiness	8	
Objections, narrow, puffed, meaty.		
Knees, neither sprung nor calf kneed, broad, straight, strong	5	
Objections, narrow, weak, crooked.		
Cannons, short, flat, broad, smooth, fine quality, yet with abundant substance	5	
Objections, round, spongy, deficient in size.		
Pasterns, strong, medium length, sound, clean, sloping	5	
Objections, too short, stiff.		
Feet, medium height, good size, round, straight, squarely set, free from contracted heels; soles and walls tough; frog full elastic	10	
Objections, flat, shelly; narrow, contracted.		
Color, characteristic of breed	2	
Size, fifteen-three to sixteen-three hands and weight proportional	5	
Coat and skin: skin soft, pliable; hair fine, silky	3	
Objections, coarse, shaggy; hide unyielding.		
Action, strong, elastic, straight, even, vigorous.	5	
Objections, low headed, awkward, sluggish.		
Symmetry and style, well proportioned; position of horse when standing and carriage when in motion, easy, graceful, strong	6	
Total	100	

NOTE.—Under the head of "Objections" only a few of the most common are named. Other defects should be scored according to their importance.

South Dakota Agricultural College.

Same as the Iowa card (see p. 28) for draft horses, with the exception that under form the term "low set" is omitted.

**The State Agricultural and Mechanical College of the University of
Tennessee.**

Scale of points.		Perfect score.	Student's score.
A. General appearance:			
1. Weight, 1,500 pounds or over; age, —; color, —	.....	4	.....
2. Height, 14 hands and up; estimated, — hands; actual, — hands	.....	4	.....
3. Conformation, broad, massive, proportioned	.....	4	.....
4. Quality, bone smooth; tendons well defined; skin and hair fine	.....	6	.....
5. Action, step smooth, long, active; trot rapid, straight, regular	.....	8	.....
6. Temperament, energetic; disposition good	.....	4	.....
B. Head and neck:			
7. Head, well defined; size medium	.....	1	.....
8. Muzzle, fine; nostrils large; lips thin, corresponding	.....	1	.....
9. Eyes, full, bright, clear; eyelids oval	.....	1	.....
10. Forehead, broad, full	.....	1	.....
11. Ears, size medium; well carried	.....	1	.....
12. Neck, muscled; crest high; throatlatch fine; windpipe large	.....	1	.....
C. Fore quarters:			
13. Shoulder, long, smooth, oblique, extending into back	.....	2	.....
14. Arm, short, muscled, thrown downward and backward; forearm well muscled, long, wide	.....	5	.....
15. Knees, clean, wide, straight, deep, strongly supported; cannons short, wide; tendons large, set back	.....	6	.....
16. Fetlocks, wide, straight, strong; pasterns, strong, sloping	.....	4	.....
17. Feet, size medium, even; horn dense; sole concave; bars strong; frog prominent, elastic; heels wide	.....	6	.....
D. Body:			
18. Withers, well muscled	.....	2	.....
19. Chest, deep, wide, low; girth large	.....	2	.....
20. Ribs, long, sprung, close	.....	2	.....
21. Back, straight, short, broad, muscled	.....	2	.....
22. Loin, wide, short, thick	.....	2	.....
23. Underline, long; flank let down	.....	1	.....
E. Hind quarters:			
24. Hips, smooth, wide, level; croup, long, wide, muscular	.....	4	.....
25. Tail, attached high, well carried	.....	1	.....
26. Thighs, long, muscular	.....	2	.....
27. Quarters, heavily muscled, deep	.....	2	.....
28. Gaskin, wide, muscled	.....	2	.....
29. Hock, well defined, wide, straight; cannons, short, wide; tendons set back	.....	12	.....
30. Fetlocks, wide, straight; pasterns, strong, sloping, defined	.....	5	.....
31. Feet, size medium, even; horn dense; frog prominent, elastic; bars strong, sole concave; heels high, wide	.....	6	.....
Total	.....	100	.....

Utah Agricultural College.

Scale of points.	Score.		
	Stand-ard.	Student's.	Corrected.
General appearance:			
Age, as indicated by teeth.....			
Height, estimated, — hands; actual, — hands.....			
Weight, estimated, — pounds; actual, — pounds; score ac- cording to age.....	4		
Form and symmetry, broad, massive, proportioned.....	4		
Quality, bone smooth, hard; tendons, lean; skin lying close to bone and tendons: hair fine.....	7		
Color, characteristic of the breed.....	2		
Action, step smooth, quick, long; walk fast; trot rapid, straight, regular.....	8		
Temperament, energetic; disposition good.....	5		
Head and neck:			
Head, size medium; broad between the eyes, lean.....	1		
Muzzle, fine; nostrils large; lips thin, even.....	1		
Eyes, full, bright, clear, intelligent.....	1		
Forehead, broad, full.....	2		
Ears, medium size, well carried.....	1		
Neck, muscled; crest high; throat clean, fine; windpipe large.....	2		
Fore quarters:			
Shoulders, sloping moderately, smooth, snug, extending into back.....	3		
Arm, short, carried back.....	1		
Forearm, heavily muscled, long, wide.....	2		
Knees, wide, clean cut, straight, deep, strongly supported.....	2		
Cannons, short, lean, wide; sinews large, set back.....	2		
Petlock, wide, clean, strong, straight.....	1		
Pasterns, sloping; strong; length, medium.....	2		
Feet, size large, even; dark colored; horn dense; sole concave; bars strong; frog large, elastic; heel wide, full, vertical.....	7		
Body:			
Chest, deep, wide, low; girth large.....	3		
Ribs, long, close, well sprung, making round barrel.....	2		
Back, straight, short, broad, muscular.....	2		
Loins, wide, short, thick, level.....	2		
Underline, flank low.....	1		
Hind quarters:			
Hips, smooth, wide.....	2		
Croup, wide, muscular.....	3		
Tail, attached medium high, well carried.....	1		
Thighs, full, muscular, thick through hams.....	2		
Quarters, deep, heavily muscled.....	4		
Gaskins (or lower thighs), wide, muscled, well down.....	2		
Hocks, large, bony, clean cut, broad, thick; lower inside bound- ary not abrupt.....	7		
Cannons, upright, wide, short; tendons large, strong, set back.....	2		
Petlocks, wide, straight, strong.....	1		
Pasterns, sloping, strong, medium length.....	2		
Feet, size large, even; horn dense, dark colored; sole concave; bars strong; frog large, elastic; heel wide, one-half length of toe and vertical to the ground.....	6		
Total.....	100		
Estimated market value.....			

College of Agriculture of the University of Wisconsin.

Scale of points.	Possible score.	Points deficient.	
		Student's score.	Corrected.
Age.....			
General appearance—29 points:			
Height, estimated, — hands; actual, — hands.....			
Weight, over 1,500 pounds; estimated, — pounds; score according to age.....	6		
Form, broad, massive, proportioned.....	4		
Quality, bone clean, strong; tendons lean, well defined; skin and hair fine; feather, when present, silky.....	6		
Action, step smooth, quick, long; trot rapid, straight, regular.....	10		
Temperament, energetic; disposition good.....	3		
Head and neck—8 points:			
Head, clean cut; size good.....	1		
Muzzle, fine; nostrils large, flexible; lips thin, even.....	1		
Eyes, full, bright, clear.....	1		
Forehead, broad, full.....	1		
Ears, size medium; well carried.....	1		
Lower jaw, angles wide; space clean.....	1		
Neck, muscled, arched; throatlatch fine; windpipe large.....	2		
Fore quarters—22 points:			
Shoulder, slightly sloping, smooth, snug, extending into back.....	3		
Arm, short, thrown back, well set.....	1		
Forearm, heavily muscled, long, wide.....	2		
Knees, clean, wide, straight, deep, strong.....	2		
Cannons, short, clean, wide; tendons large, set back.....	2		
Fetlocks, wide, straight, strong.....	1		
Pasterns, wide, straight, strong.....	3		
Feet, size large, even; horn dense; sole concave; bars strong; frog large, elastic; heel wide, one-half length of toe and vertical to ground.....	8		
Body—9 points:			
Chest, deep, wide, low; girth large.....	2		
Ribs, deep, well sprung, closely ribbed to hip.....	2		
Back, straight, short, broad, muscular.....	2		
Loins, thick, wide, short, straight.....	2		
Underline, flank low.....	1		
Hind quarters—32 points:			
Hips, wide, smooth.....	2		
Croup, wide, muscular.....	3		
Thighs, deep, heavily muscled.....	4		
Stifles, strong, muscular.....	2		
Gaskins (or lower thighs), wide, muscular.....	2		
Hocks, clean cut, wide, straight, strong.....	8		
Cannons, short, wide; tendons large, set back.....	2		
Fetlocks, wide, straight, strong.....	1		
Pasterns, strong, sloping, lengthy.....	2		
Feet, size large, even; horn dense; color dark; sole concave; bars strong; frog large, elastic; heel wide, one-half length of toe and vertical to ground.....	6		
Total.....	100		

MULES.**State Agricultural and Mechanical College of the University of Tennessee.**

Scale of points.	Perfect score.	Student's score.
A. General appearance:		
1. Weight, 900-1,200 pounds; age, —; color, —	4	
2. Height, 14 hands and up; estimated, — hands; actual, — hands	4	
3. Conformation, symmetrical, smooth	4	
4. Quality, bones clean; tendons defined; skin and hair fine	4	
5. Action, step smooth, long, active; trot rapid, straight, regular	20	
6. Temperament, energetic; good disposition	4	
B. Head and neck:		
7. Head, well defined; size medium	1	
8. Muzzle, fine; nostrils large; lips thin and corresponding	1	
9. Eyes, full, bright, clear	1	
10. Forehead, flat, broad, full	1	
11. Ears, large, well carried, tapering	1	
12. Neck, muscled, crested; throatlatch defined; windpipe large	1	
C. Fore quarters:		
13. Shoulder, long, sloping, well muscled	2	
14. Arm, short, muscled, thrown well forward and backward; forearm well muscled, long, wide	3	
15. Knees, wide, clean, straight, deep, well supported; cannons short, wide; tendons well defined	4	
16. Fetlocks, wide, straight, strong; pasterns short, clean, straight, angle with ground 45 degrees	4	
17. Feet, size medium, even; horn dense; sole concave; bars strong; frog prominent, elastic; heel wide, high	6	
18. Withers, smooth, well muscled, continuous with neck and back	2	
D. Body:		
19. Chest, deep, low; girth large	1	
20. Ribs, long, sprung, close	2	
21. Back, straight, short, well muscled	2	
22. Loin, wide, short, thick	2	
23. Underline, long; flank low	1	
E. Hind quarters:		
24. Hip, smooth, wide, level; croup wide, muscular	4	
25. Tail, attached high, well carried	1	
26. Thighs, long, well muscled, open angled	2	
27. Quarters, heavily muscled, deep	2	
28. Gaskin, wide, muscled	2	
29. Hocks, wide, well defined, strongly supported, straight; cannons short, wide; tendons set back	9	
30. Fetlocks, wide, straight; pasterns, short, angle with ground 55 degrees	5	
31. Feet, medium size, even; horn dense; frog prominent, elastic; bars strong; sole concave; heel high, wide	4	
Total	100	

BEEF CATTLE.

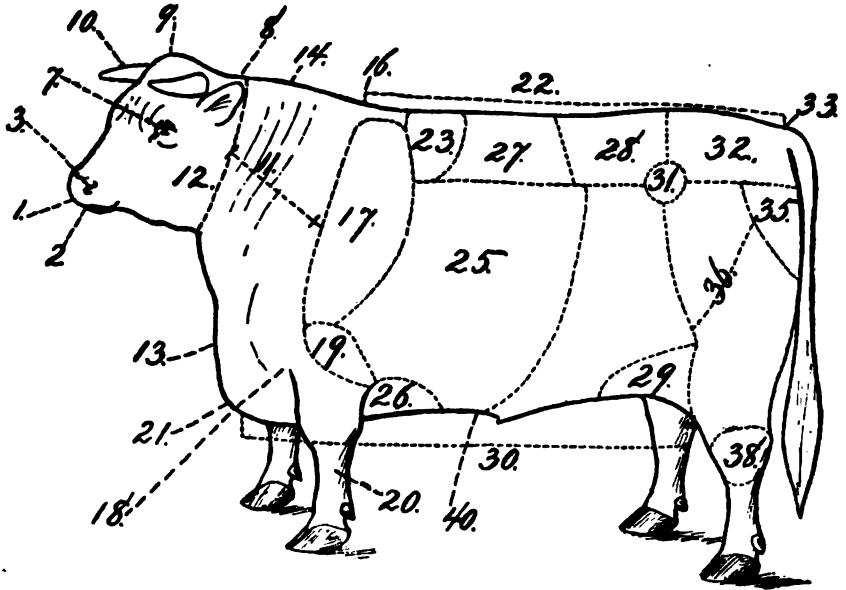


FIG. 2.—Points of beef cattle, side view.

- | | | | |
|-------------|----------------------------|------------------------|------------------------|
| 1. Muzzle. | 13. Dewlap. | 23. Crops. | 31. Hip, point of hip, |
| 2. Mouth. | 14. Top of neck, or crest. | 25. Ribs, or barrel. | hook, or hook bone. |
| 3. Nostril. | 16. Top of shoulder. | 26. Fore flank. | 32. Rump. |
| 7. Eye. | 17. Shoulder. | 27. Back, or chine. | 33. Tailhead. |
| 8. Ear. | 18. Point of shoulder. | 28. Loin. | 35. Buttocks. |
| 9. Poll. | 19. Arm. | 29. Hind flank. | 36. Thigh. |
| 10. Horn. | 20. Shank. | 30. Underline, or bot- | 38. Hock. |
| 11. Neck. | 21. Brisket. | tom line. | 40. Navel. |
| 12. Throat. | 22. Topline. | | |

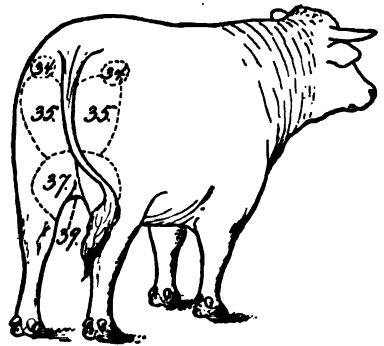
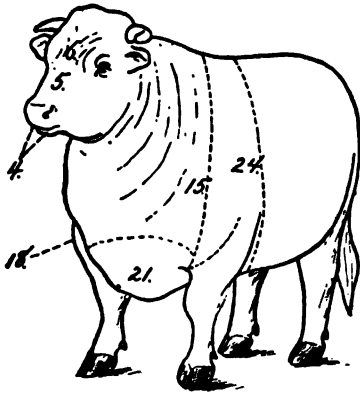


FIG. 3.—Points of beef cattle, front and rear views.

- | | | | |
|--------------|--------------------------|----------------|---------------|
| 4. Lips. | 15. Neck vein, or shoul- | 21. Brisket. | 35. Buttocks. |
| 5. Face. | der vein. | 24. Girth. | 37. Twist. |
| 6. Forehead. | 18. Point of shoulder. | 34. Pin bones. | 39. Purse. |

Alabama Polytechnic Institute.

Scale of points.	Possible score.	Student's score.	Judge's score.
General appearance:			
Weight, score according to age.....	10		
Form, straight, deep, broad, low set, stylish; top and underline parallel.....	10		
Quality, firm handling; hair fine; skin pliable; bone dense; evenly fleshed.....	10		
Condition, deep, even covering of firm flesh, especially in region of valuable cuts.....	10		
Objections, undersize; unequal development; too fine bone; patchiness.....			
Head and neck:			
Muzzle, broad, moist; mouth large; jaw wide; nostrils large.....	1		
Eyes, large, clear, placid.....	1		
Face, short, quiet, expressive.....	1		
Forehead, broad, full.....	1		
Ears, size medium; texture fine.....	1		
Horns, oval; texture fine; size medium.....	1		
Neck, short, thick; chest clean.....	1		
Objections, coarse or slim head.....			
Fore quarters:			
Shoulder vein, full, meeting shoulders well.....	2		
Shoulder, covered with flesh, medium broad above.....	2		
Brisket, advanced; breast wide.....	1		
Dewlap, skin not too loose and drooping.....	1		
Legs, straight, short; arm full; shank fine, smooth.....	2		
Objections, coarse or high shoulder points; narrow breast.....			
Body:			
Chest, full, deep, wide; girth large; crops full.....	4		
Ribs, long, arched, thickly fleshed.....	8		
Back, broad, straight, smooth, even.....	10		
Loin, thick, broad.....	8		
Flank, full, even with underline.....	2		
Objections, narrow, shallow chest; thin loin; flat ribs; narrow back.....			
Hind quarters:			
Hips, smoothly covered; distance apart in proportion to other parts.....	2		
Rump, long, wide, even; tailhead smooth, not patchy.....	2		
Pin bones, not prominent, far apart.....	1		
Thighs, full, deep, wide.....	2		
Twist, full, deep, plump.....	2		
Purse, full, indicating fleshiness.....	2		
Legs, straight, short; shank fine, smooth.....	2		
Total	100		

The State Agricultural College of Colorado.

Scale of points.	Perfect score.
General appearance:	
Weight, score according to age	6
Form, topline and underline straight, deep, broad, low set, stylish	10
Quality, firm handling; hair fine; skin pliable; bone dense; evenly fleshed	10
Condition, deep, even covering of firm flesh, especially in regions of valuable cuts	10
Head and neck:	
Muzzle, broad; mouth large; jaw wide; nostrils large	1
Eyes, large, clear, placid	1
Face, short; expression quiet	1
Forehead, broad, full	1
Ears, size medium; texture fine	1
Horns, oval; texture fine; size medium	1
Neck, thick, short; throat clean	1
Fore quarters:	
Shoulder vein, full	2
Shoulder, covered with flesh, compact on top, smooth	2
Brisket, advanced; breast wide	1
Dewlap, skin not too loose and drooping	1
Legs, straight, short; arm full; shank fine, smooth	2
Body:	
Chest, full, deep, wide; girth large; crops full	8
Ribs, long, arched, thickly fleshed	8
Back, broad, straight, smooth, even	10
Loin, thick, broad	8
Flank, full, even with underline	2
Hind quarters:	
Hips, smoothly covered; distance apart in proportion with other parts	2
Rump, long, wide, even; tail head smooth, not patchy	2
Pin bones, not prominent, far apart	1
Thighs, full, deep, wide	2
Twist, deep, plump	2
Purse, full, indicating fleshiness	2
Legs, straight, short; shank fine, smooth	2
Total	100

College of Agriculture of the University of Illinois.

Scale of points.	Possible score.	Student's score.	Corrected.
General appearance—40 points:			
Weight, estimated, — pounds; actual, — pounds; according to age	10		
Form, topline and underline straight, deep, broad, low set, stylish	10		
Quality, handling firm; hair fine; skin pliable; bone dense, clean; evenly fleshed, without ties or rolls	10		
Condition, deep, even covering of firm flesh, especially in region of valuable cuts	10		
Head and neck—7 points:			
Muzzle, mouth large; lips thin; nostrils large	1		
Eyes, large, clear, placid	1		
Face, short, quiet, expressive	1		
Forehead, broad, full	1		
Ears, size medium; texture fine	1		
Neck, thick, short; throat clean	2		
Fore quarters—9 points:			
Shoulder vein, full	2		
Shoulder, covered with flesh, compact on top, snug	3		
Brisket, advanced; breast wide	1		
Dewlap, skin not too loose and drooping	1		
Legs, straight, short; arm full; shank fine, smooth	2		
Body—30 points:			
Chest, full, deep, wide; girth large; crops full	4		
Ribs, long, arched, thickly fleshed	8		
Back, broad, straight	8		
Loin, thick, broad	8		
Flank, full, even with underline	2		
Hind quarters—14 points:			
Hips, smoothly covered; distance apart in proportion with other parts	2		
Rump, long, wide, even; tail head smooth, not patchy	2		
Pin bones, not prominent, far apart	1		
Thighs, full	3		
Twist, deep, plump, indicating fleshiness	4		
Legs, straight, short; shank, fine, smooth	2		
Total	100		

School of Agriculture of Purdue University.

Same as the Illinois card (see p. 42), with the following exceptions: Under face, omit "quiet;" under rump, read "tailhead wide, smooth, not patchy." There are also some slight differences in phraseology.

Iowa State College of Agriculture and the Mechanic Arts.

Scale of points.	Perfect score.
General appearance:	
1. Weight, — pounds; score according to age	10
2. Form, topline and underline straight; deep, broad, low set, stylish	10
3. Quality, hair fine; skin pliable; bone dense, clean; firm covering of flesh without any ties or rolls	10
4. Condition, deep, even covering of firm flesh, especially in regions of valuable cuts ..	10
Head and neck:	
5. Muzzle, broad; mouth large; jaw wide; nostrils large	1
6. Eyes, large, clear, placid	1
7. Face, short; expression quiet	1
8. Forehead, broad, full	1
9. Ears, size medium; texture fine	1
10. Horns, oval; texture fine; size medium	1
11. Neck, thick, short; throat clean	1
Fore quarters:	
12. Shoulder vein, full	2
13. Shoulder, covered with flesh, compact on top, smooth	2
14. Brisket, advanced; breast wide	1
15. Dewlap, skin not too loose and drooping	1
16. Legs, straight, short; arm full; shank fine, smooth	2
Body:	
17. Chest, full, deep, wide; girth large; crops full	4
18. Ribs, long, arched, thickly fleshed	8
19. Back, broad, straight, smooth, even	10
20. Loin, thick, broad	8
21. Flank, full, even with underline	2
Hind quarters:	
22. Hips, smoothly covered; distance apart in proportion with other parts	2
23. Rump, long, wide, even; tailhead smooth, not patchy	2
24. Pin bones, not prominent, far apart	1
25. Thighs, full, deep, wide	2
26. Twist, deep, plump	2
27. Purse, full, indicating fleshiness	2
28. Legs, straight, short; shank fine, smooth	2
Total	100

Kansas State Agricultural College.

Same as the Iowa card (see above) for beef cattle, with the following exceptions: Under quality, read "firm handling; hair fine; skin pliable; bone dense; evenly fleshed." Under shoulder, omit "compact on top, smooth."

Agricultural and Mechanical College of Kentucky.

Same as Iowa card (see above), except that under quality read "firm handling; hair fine; skin pliable; bone dense; evenly fleshed."

Maryland Agricultural College.

Same as Michigan card (see p. 44), with one exception: Under twist, read "deep, full."

Michigan State Agricultural College.

Scale of points.	Per- fect.	Student's estimate.	Corrected.
General appearance:			
Age, estimated, —; corrected, —.			
Weight, estimated, — pounds; corrected, — pounds.			
Form, square, blocky, broad, top and bottom lines straight.....	8		
Quality, hair fine, soft; skin mellow, loose, pliable, of medium thickness; bone fine, clean.....	8		
Temperament, quiet.....	3		
Style.....	1		
	20		
Head and neck:			
Muzzle, clean cut, fine; mouth large; lips thin; nostrils wide, open.....	2		
Face, short, clean, symmetrical.....	2		
Eyes, full, bright, placid.....	1		
Forehead, broad.....	1		
Ears, size medium; texture fine; covered with fine hair.....	1		
Horn, waxy; texture fine.....	1		
Neck, thick, short, set firmly on shoulders.....	3		
	11		
Fore quarters:			
Shoulder, compact, well covered with flesh.....	7		
Chest, full, deep, thick through the heart.....	4		
Briкет, deep, moderately projecting; breast wide.....	2		
Legs, straight, short, wide apart, strong; bone clean; arm full	3		
	16		
Body:			
Girth, — feet, — inches.....	4		
Crops, full.....	3		
Ribs, well sprung, arched, deep.....	5		
Back, broad, straight, short.....	5		
Loin, full, thick, broad.....	5		
Flank, full, low, thick, making underline straight.....	3		
	25		
Hind quarters:			
Hips, wide apart, smooth.....	4		
Rump, long, level, wide.....	5		
Pin bones, not prominent, far apart.....	3		
Tail, base smooth; bone fine, clean; hair of switch fine.....	2		
Thigh, full, well fleshed.....	4		
Twist, deep.....	5		
Purse, full.....	2		
Legs, short, straight; bone fine, clean.....	3		
	28		
Total	100		

College of Agriculture of the University of Minnesota.

Scale of points.		Perfect score.
General appearance:		
1. Weight, score according to age		10
2. Form, topline and underline straight; deep, broad, low set, stylish		10
3. Quality, hair fine; skin pliable; bone dense; flesh firm, even, deep, especially in regions of valuable cuts		12
4. Condition, good health; vigorous; fat abundant, evenly distributed		8
Head and neck:		
5. Muzzle, broad; mouth large; jaw wide; nostrils large		1
6. Eyes, large, clear, placid		1
7. Face, short; expression quiet		1
8. Forehead, broad, full		1
9. Ears, size medium; texture fine		1
10. Horns, oval; texture fine; size medium		1
11. Neck, thick, short; throat clean		1
Fore quarters:		
12. Shoulder vein, full		2
13. Shoulder, covered with flesh, compact on top, smooth		2
14. Brisket, advanced; breast wide		1
15. Dewlap, skin not too loose and drooping		1
16. Legs, straight, short; arm full; shank fine, smooth		2
Body:		
17. Chest, full, deep, wide; girth large; crops full		4
18. Ribs, long, arched, thickly fleshed		8
19. Back, broad, straight, smooth, even		10
20. Loin, thick, broad		8
21. Flank, full, even with underline		2
Hind quarters:		
22. Hips, smoothly covered; distance apart in proportion with other parts		2
23. Rump, long, wide, even; tail head smooth, not patchy		2
24. Pin bones, not prominent, far apart		1
25. Thighs, full, deep, wide		4
26. Twist, deep, plump		1
27. Purse, full, indicating fleshiness		1
28. Legs, straight, short; shank fine, smooth		2
Total		100

College of Agriculture and the Mechanic Arts of the University of Missouri.

Scale of points.	Per- fect.	Student's estimate.	Corrected.
General appearance:			
Age, estimated, —; corrected, —			
Weight, estimated, — pounds; corrected, — pounds.			
Form, square, blocky, broad; top and bottom lines straight	8		
Quality, fine, soft hair; skin mellow, loose, pliable, of medium thickness; bone fine, clean	8		
Temperament, quiet	3		
	19		
Head and neck:			
Muzzle, clean cut, fine; mouth large; lips thin; nostrils wide, open	2		
Face, short, not lean	3		
Eyes, full, bright, clear	1		
Forehead, broad, full, high	1		
Ears, size medium; texture fine; covered with fine hair	1		
Horn, wax; texture fine	1		
Neck, thick, short, set firmly on shoulders	3		
	12		
Fore quarters:			
Shoulder vein, full	3		
Shoulder, compact, well covered with flesh	3		
Chest, full, deep, thick through the heart	5		
Brisket, deep, moderately projecting; breast wide	1		
Legs, straight, short, wide apart; bone strong, clean; arm full	3		
	15		
Body:			
Girth, large; estimated, —; corrected, —	4		
Crops, full	3		
Ribs, well sprung, arched, deep, thick fleshed	6		
Back, broad, straight, short	5		
Loin, full, thick, broad	6		
Flank, full, low, thick, making underline straight	4		
	27		
Hind quarters:			
Hips, wide apart, smooth	4		
Rump, long, level, wide	5		
Pin bones, not prominent, far apart	3		
Tail, base smooth; bone fine, clean; hair of switch fine	3		
Thigh, full, well fleshed	4		
Twist, deep	6		
Legs, short, straight; bone fine, clean	3		
	27		
Total	100		

New Hampshire College of Agriculture and the Mechanic Arts.

Scale of points.	Perfect score.	Points deficient.	
		Student's score.	Corrected.
A. General appearance:			
Weight, estimated, — pounds; actual, — pounds; score according to age.....	5		
Form, topline and underlines straight; deep, broad, low set.....	8		
Quality, handling firm; hair fine; skin pliable; bone dense; evenly fleshed.....	8		
Style, active, upstanding.....	1		
Temperament.....	5		
B. Head and neck:			
Muzzle, fine; mouth large; lips thin; nostrils large.....	1		
Eyes, large, clear, placid.....	1		
Face, short; expression quiet.....	1		
Forehead, broad, full.....	1		
Ears, size medium; texture fine.....	1		
Neck, thick, short; throat clean.....	2		
C. Fore quarters:			
Shoulder vein, full.....	3		
Shoulder, covered with flesh, compact on top, snug.....	4		
Brisket, advanced; breast wide.....	2		
Dewlap, skin not too loose and drooping.....	1		
Legs, straight, short; arm full; shank fine, smooth.....	3		
D. Body:			
Chest, full, deep, wide; girth large; crops full.....	10		
Ribs, long, arched, thickly fleshed.....	5		
Back, broad, straight.....	6		
Loin, thick, broad.....	5		
Flank, full, even with underline.....	3		
E. Hind quarters:			
Hips, smoothly covered; distance apart in proportion with other parts.....	4		
Rump, long, even, wide; tailhead smooth, not patchy.....	5		
Pin bones, not prominent, far apart.....	3		
Thighs, full.....	3		
Twist, deep, plump.....	4		
Purse, full, indicating fleshiness.....	2		
Legs, straight, short; shank fine, smooth.....	3		
Total	100		

New Mexico College of Agriculture and Mechanic Arts.

Same as the Iowa card (see p. 43) for beef cattle, with the following exception: Under quality, read "firm handling; hair fine; skin pliable; bone dense; evenly fleshed."

North Carolina College of Agriculture and Mechanic Arts.

Same as the New Hampshire card (see above) for beef cattle.

North Dakota Agricultural College.

Scale of points. ^a	Perfect score.	Points deficient	
		Student's score.	Corrected
General appearance:			
Weight, estimated, — pounds; according to age	6		
Form, topline and underline straight; deep, broad, low, set, stylish	8		
Quality, handling firm; hair fine; skin pliable; bone dense; evenly fleshed	8		
Temperament, quiet	5		
Head and neck:			
Muzzle, mouth large; lips thin; nostrils large	1		
Eyes, large, clear, placid	1		
Face, short; expression quiet	1		
Forehead, broad, full	1		
Ears, size medium; texture fine	1		
Neck, thick, short; throat clean	2		
Fore quarters:			
Shoulder vein, full	3		
Shoulder, covered with flesh, compact on top, snug	4		
Brisket, advanced; breast wide	2		
Dewlap, skin not too loose and drooping	1		
Legs, straight, short; arm full; shank fine, smooth	3		
Body:			
Chest, full, deep, wide; girth large; crops full	8		
Ribs, long, arched, thickly fleshed	6		
Back, broad, straight	6		
Loin, thick, broad	5		
Flank, full, even with underline	4		
Hind quarters:			
Hips, smoothly covered; distance apart in proportion with other parts	4		
Rump, long, even, wide; tailhead smooth, not patchy	5		
Pin bones, not prominent, far apart	3		
Thighs, full	3		
Twist, deep, plump	4		
Fur, full, indicating fleshiness	2		
Legs, straight, short; shank fine, smooth	3		
Total	100		

^aAfter Craig.

The College of Agriculture and Domestic Science, Ohio State University.

Scale of points.	Perfect score.	Points deficient.	
		Student's score.	Corrected.
Measurements:			
Height, at withers, — hands; height at sternum, — hands.....			
Heart girth, —; length of body, —.....			
Weight, estimated, — pounds; actual, — pounds.....			
A. General appearance:			
Size, score according to age and breed; mature bulls, 2,000; mature cows, 1,600; 30-month steers, 1,500 pounds.....	8		
Form, body resembling parallelogram; long, broad, deep, low; topline and underline straight; equally and smoothly developed throughout; symmetrical.....	8		
Quality, hair, soft, silky, assuming a thick furry character in winter, not coarse, wiry, or harsh; skin rather thick, pliable to touch, not papery, covering a mellow elastic cushion of evenly distributed flesh; bone dense, clean.....	10		
Constitution and temperament, vigorous, but mild and quiet; carriage graceful; step firm; bulls showing masculinity and individuality; cows showing femininity and refinement.....	4		
B. Head:			
Size, medium; parts well defined; substantial; face rather short.....	1		
Muzzle, broad, full; mouth and nostril large.....	1		
Eyes, large, clear, placid, wide apart.....	1		
Forehead, broad, only moderately dished; in bulls preferably full.....	1		
Horns, texture good; neat, but strong, typical of breed.....	1		
Ears, size and texture medium; broad rather than long; under good control.....	1		
C. Fore quarters:			
Neck, thick, short, insensibly joining the body at all points; throat clean; bulls showing decided crest.....	8		
Shoulders, not too prominent; blades well covered with flesh and not too upright; compact on top.....	4		
Breast, broad, deep; brisket advanced; dewlap not too loose and drooping.....	8		
Legs, short, straight, well placed; arm full; shank fine.....	2		
D. Body:			
Chest, deep, wide, full; heart girth large; crops filling up even behind shoulders; sternum level, full; stomach not too prominent, making underline straight.....	10		
Back, broad, level, straight, well covered with flesh; spinal column not evident.....	8		
Loin, broad, level, straight, well covered with flesh.....	6		
Ribs, long, convex, close, thickly fleshed, not evident.....	4		
Flanks, full, thick, low, even with underline.....	3		
E. Hind quarters:			
Hips, wide apart but not prominent, especially in bulls; well and smoothly covered.....	4		
Rump, long, wide, well covered with flesh so as to carry straight lines from hips to tailhead and to pin bones; pin bones good distance apart, but not prominent or patchy.....	8		
Tail, fat and broad at root, fitting closely and smoothly to back line; fine.....	1		
Thighs, carrying large amount of flesh, as indicated by width, thickness, and by well descended, square, upright or slightly rounded bullocks and low twist; in steers, purse full, indicating fleshiness.....	5		
Legs, straight, short; shank fine; standing firmly on feet; proper distance apart.....	3		
Total	100		

Oklahoma Agricultural and Mechanical College.

Scale of points.	Possible score.	Name of animal.
General appearance—40 points:		
Weight, 12 months, 800 pounds; 18 months, 1,100 pounds; 24 months, 1,300 pounds; 36 months, 1,700 pounds. Estimated, — pounds; actual — pounds; score according to age —	10	
Form, topline and underline straight; deep, broad, low set, stylish	10	
Quality, firm handling; hair fine; skin pliable; bone dense, clean; evenly fleshed, without ties or rolls	10	
Condition, deep, even covering of firm flesh, especially in region of valuable cuts	10	
Head and neck—7 points:		
Muzzle, broad; lips moderately thin; nostrils large	1	
Eyes, large, clear, placid	1	
Face, short; expression quiet	1	
Forehead, broad, full	1	
Ears, size medium; texture fine	1	
Neck, thick, short; throat clean	2	
Fore quarters—9 points:		
Shoulder vein, full	2	
Shoulder, covered with flesh, compact on top, smooth	3	
Brisket, advanced; breast wide	1	
Dewlap, skin not too loose and drooping	1	
Legs, straight, short; arm full; shank fine, smooth	2	
Body—30 points:		
Chest, wide, deep, full; girth large; crops full	4	
Ribs, long, arched, thickly fleshed	8	
Back, broad, straight, smooth	8	
Loin, thick, broad, extending well forward	8	
Flank, full, even with underline	2	
Hind quarters—14 points:		
Hips, smoothly covered; distance apart in proportion to other parts	2	
Rump, long, wide, even; tailhead smooth, not patchy	2	
Pin bones, not prominent, far apart	1	
Thighs, full, wide	3	
Twist, plump, deep; purse in steers full, indicating fleshiness	4	
Legs, straight, short; shank fine, smooth	2	
Total	100	

Oregon State Agricultural College.

Scale of points.	Possible score.	Student's estimate.	Corrected.
1. Weight, estimated, — pounds; actual, — pounds	6		
2. Form, topline and underline straight; deep, broad, low set	8		
3. Quality, firm handling; hair fine; skin pliable; bone dense; evenly fleshed	8		
4. Style, active, upstanding	1		
5. Temperament	5		
6. Muzzle, fine; mouth large; lips thin; nostrils large	1		
7. Eyes, large, clear, placid	1		
8. Face, short; expression quiet	1		
9. Forehead, broad, full	1		
10. Ears, size medium; texture fine	1		
11. Neck, thick, short; throat clean	2		
12. Shoulder vein, full	3		
13. Shoulders, covered with flesh, compact on top, snug	4		
14. Brisket, advanced; breast wide	2		
15. Dewlap, skin not too loose and drooping	1		
16. Legs, straight, short; arm full; shank fine, smooth	3		
17. Chest, full, deep, wide; girth large; crops full	10		
18. Ribs, long, arched, thickly fleshed	5		
19. Back, broad, straight	6		
20. Loin, thick, broad	6		
21. Flank, full, even with underline	2		
22. Hips, smoothly covered; distance apart in proportion with other parts	4		
23. Rump, long, even, wide; tailhead smooth, not patchy	5		
24. Pin bones, not too prominent, far apart, level	3		
25. Thighs, full	4		
26. Twist, deep, plump	4		
27. Legs, straight, short; shank fine, smooth	3		
Total	100		

The Pennsylvania State College.

Scale of points.	Perfect score.	Points deficient.	
		Student's score.	Corrected.
General appearance:			
Weight, estimated, — pounds, according to age	6		
Form, topline and underline straight; deep, broad, low set, stylish	8		
Quality, firm handling; hair fine; skin pliable; bone dense; evenly fleshed	8		
Temperament, quiet	5		
Head and neck:			
Muzzle, mouth large; lips thin; nostrils large	1		
Eyes, large, clear, placid	1		
Face, short; expression quiet	1		
Forehead, broad, full	1		
Ears, size medium; texture fine	1		
Neck, thick, short; throat clean	2		
Fore quarters:			
Shoulder vein, full	3		
Shoulder, covered with flesh, compact on top, snug	4		
Brisket, advanced; breast wide	2		
Dewlap, skin not too loose and drooping	1		
Legs, straight, short; arm full; shank fine, smooth	3		
Body:			
Chest, full, deep, wide; girth large; crops full	8		
Ribs, long, arched, thickly fleshed	6		
Back, broad, straight	6		
Loin, thick, broad	5		
Flank, full, even with underline	4		
Hind quarters:			
Hips, smoothly covered; distance apart in proportion with other parts	4		
Rump, long, even, wide; tailhead smooth, not patchy	5		
Pin bones, not prominent, far apart	3		
Thighs, full	3		
Twist, deep, plump	1		
Purse, full, indicating fleshiness	2		
Legs, straight, short; shank fine, smooth	3		
Total	100		

South Dakota Agricultural College.

Same as the Iowa card (see p. 43) for beef cattle.

State Agricultural and Mechanical College of the University of Tennessee.

Scale of points.		Possible score.	Student's score.
A. General appearance:			
1. Estimated weight, — pounds; actual, — pounds.....			
2. Weight, according to age: yearling, 800; two-year, 1,200.....		5	
3. Form, deep, broad, low set; with straight topline and underline.....		6	
4. Quality, hair fine; skin pliable; bone dense; all parts evenly covered with firm flesh.....		6	
5. Style, active, sprightly.....		1	
6. Temperament, neither sluggish nor wild.....		4	
7. Constitution, vigorous, robust, showing size and substance.....		4	
B. Head and neck:			
8. Muzzle, fine; mouth large; lips thin; nostrils large.....		1	
9. Eyes, large, clear, placid.....		1	
10. Face, short; expression quiet.....		1	
11. Forehead, broad, full.....		1	
12. Ears, medium in size and fine in texture.....		1	
13. Neck, thick, short; throat clean.....		2	
C. Fore quarters:			
14. Shoulder vein, full.....		3	
15. Shoulders, smooth, well fleshed, compact on top.....		4	
16. Brisket, extending well forward; breast wide.....		2	
17. Dewlap, light.....		1	
18. Legs, straight, short; arm full; shank fine, smooth.....		3	
D. Body:			
19. Chest, full, deep, wide; girth large; crops full.....		10	
20. Ribs, long, well arched, thickly fleshed.....		5	
21. Back, broad, straight.....		6	
22. Loin, thick, broad.....		5	
23. Flank full, even with underline.....		3	
E. Hind quarters:			
24. Hips, smooth, proportionately wide.....		4	
25. Rump, long, even, wide; tailhead smooth.....		5	
26. Pin bones, smooth, well set apart.....		3	
27. Thighs, full.....		3	
28. Twist, deep, plump.....		4	
29. Purse, full.....		2	
30. Legs, straight, short; shank fine, smooth.....		3	
31. Tail, fine.....		1	
Total.....		100	

State Agricultural and Mechanical College of the University of Tennessee.

Scale of points.	Perfect score.	Student's score.
I. Primary considerations:		
1. Weight, — pounds	8	
2. Size and substance, for age	4	
3. Style, attractive, sprightly; breeding apparent	4	
4. Appearance, square, blocky, rectangular	4	
5. Quality, skin thin, loose, elastic, mellow; flesh firm; hair soft, fine, silky	5	
II. Nervous energy:		
6. Temperament, active, controlled	5	
7. Eyes, large, clear, bright, mild, placid, free from white	6	
8. Forehead, broad, high	3	
9. Ears, broad, thin, active	2	
10. Spinal column, long, well covered	6	
11. Navel, large, defined	2	
III. Structural anatomy:		
12. Contour, clean-cut, smooth, correlated, symmetrical, free from patchiness and offal	2	
13. Head, medium in size; muzzle refined; mouth large; face short	1	
14. Neck, full, medium length, cylindrical; throat clean; dewlap light	1	
15. Withers, broad on top, well fleshed; shoulder well covered, slanting	1	
16. Back, straight, strong, well covered	2	
17. Loin, broad, strong, well covered	8	
18. Pelvic arch, suppressed, well covered; pin bones wide	2	
19. Flank, low; twist full; thigh full, recurved	1	
20. Bones, medium; joints fine, flat; horns small, waxy; tail long, bone fine	2	
IV. Digestion and assimilation:		
21. Nostrils, medium-sized, clear, bright	1	
22. Breast and brisket, prominent, full, low	1	
23. Chest, wide, deep, long; girth large	8	
24. Barrel, medium long, broad, cylindrical, deep, capacious	9	
25. Ribs, flat, close together, well sprung	3	
26. False ribs, well developed	3	
V. Essential qualities:		
27. Straight top, side, and bottom lines; large girths at flank; navel and loin of about equal dimensions	4	
28. Close conformation; evenly and deeply covered with firm, springy flesh, free from patchiness	6	
29. Muscular and meaty, in loin and hind quarter	4	
30. Good size and weight, for age, indicating early maturity	3	
31. Constitution, good; bone sufficient for weight	3	
Total	100	

Agricultural College of Utah.

Scale of points.	Score.		
	Stand- ard.	Student's.	Corrected.
General appearance:			
Age, estimated, —; corrected, —			
Weight, estimated, — pounds; corrected, — pounds; score according to age	4		
Form, topline and underline straight; deep, broad, low set, stylish	10		
Quality, firm handling; hair fine; skin pliable; bone dense; evenly fleshed	10		
Temperament, quiet	4		
Head and neck:			
Muzzle, clean cut, fine; mouth large; lips thin; nostrils large	1		
Eyes, large, clear, placid	1		
Face, short, not lean; expression quiet	1		
Forehead, broad, full	1		
Ears, size medium; texture fine	1		
Neck, thick, short; throat clean	2		
Fore quarters:			
Shoulder vein, full	3		
Shoulder, covered with flesh, compact on top, snug	3		
Withers, wide, level	1		
Brisket, advanced; breast wide	2		
Dewlap, skin not too loose and drooping, mellow	1		
Legs, straight, short; arm full; shank fine, smooth; wide apart	2		
Body:			
Chest, full, deep, wide; girth large; crops full	8		
Girth, — feet, — inches			
Crops, full, filling up even behind shoulder	4		
Ribs, long, close, arched, thickly fleshed	3		
Back, broad, straight, short	6		
Loin, thick, broad, full	5		
Flank, full, even with underline	3		
Hind quarters:			
Hip, smoothly covered; distance apart in proportion to other parts	4		
Rump, long, even, wide; tailhead smooth, not patchy	5		
Pin bones, not prominent, far apart	3		
Thighs, full, well fleshed	3		
Twist, deep, plump	4		
Purse, full, indicating fleshiness	2		
Legs, straight, short; shanks fine, smooth	3		
Total	100		

Virginia Agricultural and Mechanical College and Polytechnic Institute.

Same as the Iowa card (see p. 43) for beef cattle

Washington Agricultural College and School of Science.

Scale of Points.	Perfect score.	Points deficient.	
		Student's score.	Corrected.
A. General appearance—28:			
Weight, estimated, — pounds; according to age.....	6		
Form, topline and underline straight; deep, broad, low set.....	8		
Quality, handling firm; hair fine; skin pliable; bone dense; evenly fleshed.....	8		
Style, active, upstanding.....	1		
Temperament.....	5		
B. Head and neck—7:			
Muzzle, fine; mouth large; lips thin; nostrils large.....	1		
Eyes, large, clear, placid.....	1		
Face, short; expression quiet.....	1		
Forehead, broad, full.....	1		
Ears, size medium; texture fine.....	1		
Neck, thick, short; throat clean.....	2		
C. Fore quarters—12:			
Shoulder vein, full.....	2		
Shoulder, covered with flesh, compact on top, snug.....	4		
Briкет, advanced; breast wide.....	2		
Dewlap, skin not too loose and drooping.....	1		
Legs, straight, short; arm full; shank fine, smooth.....	3		
D. Body—29:			
Chest, full, deep, wide; girth large; crops full.....	10		
Ribs, long, arched, thickly fleshed.....	5		
Back, broad, straight.....	6		
Loin, thick, broad.....	5		
Flank, full, even with underline.....	3		
E. Hind quarters—24:			
Hips, smoothly covered, distance apart in proportion with other parts.....	4		
Rump, long, even, wide; tailhead smooth, not patchy.....	5		
Pin bones, not prominent, far apart.....	3		
Thighs, full.....	3		
Twist, deep, plump.....	4		
Purse, or udder, full, indicating fleshiness.....	2		
Legs, straight, short; shank fine, smooth.....	3		
Total.....	100		

College of Agriculture of the University of Wisconsin.

Scale of points.	Possible score.	Points deficient.	
		Student's score.	Corrected.
General appearance—25 points:			
Weight, estimated, — pounds; according to age	6		
Form, topline and underline straight; deep, broad, low set	8		
Quality, handling firm; hair fine; skin pliable; bone fine; evenly fleshed	8		
Style, active, upstanding	1		
Temperament, quiet, docile	3		
Head and neck—8 points:			
Muzzle, good size; mouth large; lips thin; nostrils large	2		
Eyes, large, clear, placid	1		
Face, short; expression quiet	1		
Forehead, broad, full	1		
Ears, size medium; texture fine	1		
Neck, thick, short; throat clean	2		
Fore quarters—13 points:			
Shoulder vein, full	3		
Shoulder, covered with flesh, compact on top, snug	4		
Breast, wide; brisket prominent	2		
Dewlap, skin not too loose and drooping	1		
Legs, straight, short; arm full; shank fine, smooth	3		
Body—28 points:			
Chest, full, deep, wide; girth large; fore flank full	6		
Crops, full, even with shoulders	3		
Ribs, deep, arched, thickly fleshed	5		
Back, broad, straight, evenly fleshed	6		
Loin, thick, broad	5		
Flank, full, even with underline	3		
Hind quarters—25 points:			
Hips, smoothly covered; distance apart in proportion with other parts	4		
Rump, long, even, wide; tailhead smooth, not patchy	5		
Pin bones, not prominent, far apart	3		
Thighs, full, wide, deep	5		
Twist, deep, plump	4		
Purse, full, indicating fleshiness	2		
Legs, straight, short; shank fine, smooth	2		
Total	100		

STORE CATTLE.

Oklahoma Agricultural and Mechanical College.

Scale of points.	Possible score.	Name of animals.			
General appearance—40 points:					
Weight, estimated, — pounds; actual, — pounds; according to age	8				
Form, topline straight; blocky, low set, in general a parallelogram, deep, broad; heart girth large, showing strong constitution; stylish; the animal should have a moderately large barrel, indicating a large capacity for storing and utilizing food.....	15				
Quality, skin mellow, pliable, covered with fine, mossy hair; bone dense, clean.....	10				
Condition, moderate covering of flesh, especially in region of valuable cuts.....	5				
Disposition, quiet, but not sluggish.....	2				
Head and neck—7 points:					
Muzzle, broad; mouth large; jaw wide; nostrils large.....	2				
Eyes, large, clear, placid.....	1				
Face, short; expression quiet.....	1				
Forehead, broad, full.....	5				
Ears, texture fine; size medium.....	5				
Neck, thick, short; throat clean.....	2				
Fore quarters—8 points:					
Shoulder vein, well filled, giving a smooth blending of the neck to the shoulder.....	1				
Shoulder, well laid in, smooth, with an even covering of flesh; not heavy and coarse.....	3				
Brisket, advanced; breast wide.....	1				
Dewlap, skin not too loose and drooping.....	1				
Legs, straight, short; arm full; shank fine, smooth.....	2				
Body—32 points:					
Chest, full, deep, wide; girth large; crops full; fore flank well filled, showing strong constitution.....	7				
Ribs, long, arched, well fleeced.....	6				
Back, broad, straight, smooth, even.....	10				
Loin, broad, moderately thick, extending well forward.....	7				
Flank, full, even with underline.....	2				
Hind quarters—13 points:					
Hips, smoothly covered; distance apart in proportion with other parts, but not prominent.....	2				
Rump, long, wide, even; tailhead smooth; tail well set.....	3				
Pin bones, not prominent, far apart.....	1				
Thighs, full, deep, wide.....	3				
Twist, plump, deep.....	2				
Legs, straight, short; shank fine, smooth.....	2				
Total	100				

DAIRY CATTLE.

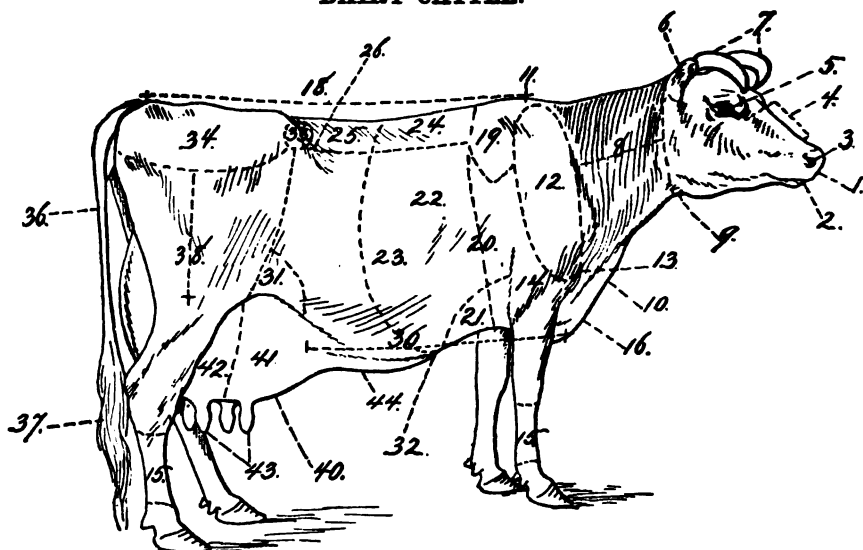


FIG. 4.—Points of the dairy cow, side view.

- | | | | |
|-------------|-------------------------|---------------------------|-----------------------------------|
| 1. Muzzle. | 11. Withers. | 22. Ribs. | 36. Tail. |
| 2. Mouth. | 12. Shoulder. | 23. False ribs. | 37. Switch, or brush. |
| 3. Nostril. | 13. Point of shoulder. | 24. Back, or chine. | 38. Thigh. |
| 4. Face. | 14. Arm. | 25. Loin. | 40. Udder. |
| 5. Eye. | 15. Shanks, or cannons. | 26. Coupling. | 41. Fore udder. |
| 6. Ear. | 16. Brisket. | 30. Underline. | 42. Hind udder. |
| 7. Horns. | 18. Topline. | 31. Hind flank. | 43. Teats. |
| 8. Neck. | 19. Crop. | 32. Navel. | 44. Mammary veins, or milk veins. |
| 9. Throat. | 20. Girth. | 33. Hip, or point of hip. | |
| 10. Dewlap. | 21. Fore flank. | 34. Rump. | |

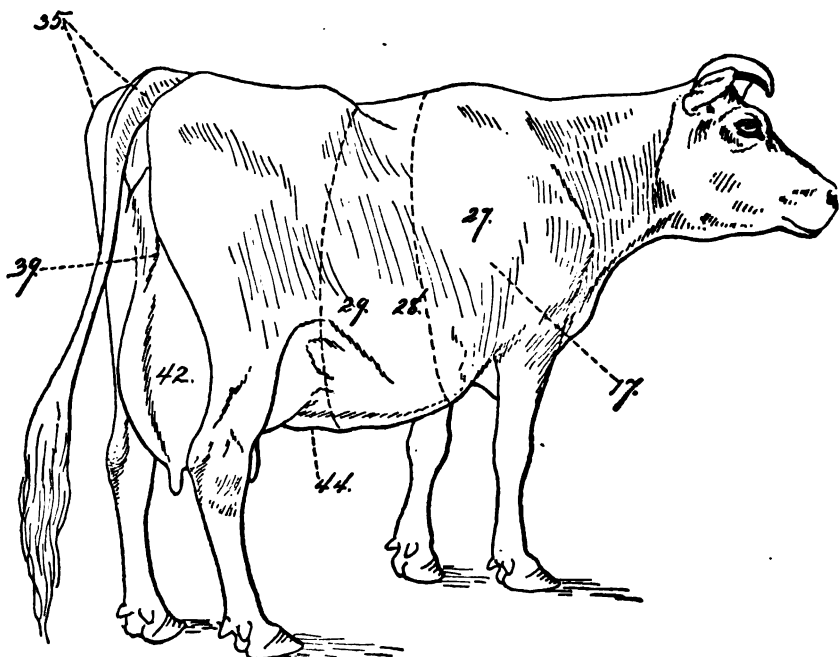


FIG. 5.—Points of the dairy cow, three-quarters rear view.

- | | | |
|------------------------|---------------------------|--------------------|
| 28. Barrel depression. | 35. Pin bones, or thurls. | 42. Hind udder. |
| 29. Stomach, or belly. | 39. Escutcheon. | 44. Mammary veins. |

Alabama Polytechnic Institute.

	Possible score.	Student's score.	Judge's score.
General appearance:			
Size, medium to large	3		
Form, inclined to be wedge shaped	5		
Quality, hair fine, soft; skin mellow, loose, medium thickness; secretion, yellow; bone, clean, fine	5		
Temperament, nervous, indicated by lean appearance when in milk	5		
Objections, undersize, too excitable			
Head and neck:			
Muzzle, moist, clean cut; mouth large; nostrils large	1		
Eyes, large, bright, full, mild	1		
Face, lean, long, quiet, expressive	1		
Forehead, broad, dishing	1		
Ears, size medium; inside yellow; texture fine	1		
Horns, texture fine	1		
Neck, fine; length medium; throat clean; dewlap light	1		
Objections, thick, coarse head and neck			
Fore quarters:			
Withers, lean, thin	1		
Shoulders, light, oblique	2		
Legs, straight, short; shank fine	2		
Objections, broad withers; heavy shoulders; legs close together			
Body:			
Chest, deep, low; girth large, with full foreflank	10		
Barrel, ribs broad, long, wide apart; stomach large	10		
Back, lean, straight, open jointed	2		
Loin, broad	2		
Navel, large	2		
Objections, narrow chest; shallow, close-coupled barrel; straight underline			
Hind quarters:			
Hips, far apart, level	2		
Rump long, wide; pelvis roomy	2		
Pin bones (or thurls), high, wide apart	1		
Tail, long, slim; hair in switch fine	1		
Thighs, thin, long	4		
Escutcheon, spreading over thighs, extending high and wide; large thigh ovals	2		
Udder, long, attached high and full behind, extending far in front and full, flexible; quarters even, free from fleshiness	20		
Teats, large, evenly placed	5		
Mammary veins, large, long, tortuous, branched, with double extension; milk wells large, numerous	5		
Legs, straight, shank fine	2		
Objections, narrow hips; small, uneven, fleshy, or too large udder; small, uneven-sized teats			
Total	100		

School of Agriculture of Purdue University.

Scale of points.	Score.					
	Male.			Female.		
	Standard.	Student's.	Corrected.	Standard.	Student's.	Corrected.
A. General appearance:						
Weight, estimated, — pounds; actual, — pounds.....	1			1		
Form, wedge shape from front, side, and top.....				8		
Form, shapely, masculine, medium long.....	10					
Quality, hair fine, silky; skin mellow, loose, medium thick, yellow, not fleshy; bone fine.....	10			8		
B. Head and neck:						
Muzzle, broad; nostrils large; nose fine between muzzle and eyes.....	1			1		
Eyes, full, placid.....	2			1		
Face, lean, fine, shapely.....	1			1		
Forehead, dishing, broad between eyes.....	2			2		
Ears, size medium; inside fine, yellow.....	1			1		
Neck, fine, rather long, well set on shoulders and head; topline slightly curved; throat clean; dewlap light.....				2		
Neck, neatly joined to head and shoulders, of good length; masculine and strong of bearing, nearly free of dewlap.....	5					
C. Fore quarters:						
Withers, lean, thin.....				1		
Withers, well rounded, even on top.....	2					
Shoulders, light, oblique.....	4			2		
Legs, straight, short; shank fine; feet well placed.....	3			3		
D. Body:						
Chest, deep, low, full; girth large.....	10			9		
Crope, well filled out.....	3			1		
Ribs, long, broad, well sprung, wide apart.....	8			8		
Back, fairly level to set of tail, broad, strong.....	3			1		
Loin, broad, long, level.....	5			4		
Flanks, low.....	2			1		
Navel, prominent.....	1			1		
E. Hind quarters:						
Hips, wide apart.....	2			2		
Rumps, long, broad, level.....	2			2		
Pin bones (or thurls), high, wide apart.....	1			1		
Thighs, thin, roomy, long, well carried.....	3			2		
Tail, long, fine, reaching hocks; good switch.....	1			1		
Legs, straight, short, wide apart; shank fine.....	2			2		
F. Udder and rudimentaries:						
Front udder, carried well forward, full, thick, soft, mellow within.....				12		
Hind udder, full in form, well up behind.....				10		
Milk veins, large, long, elastic, tortuous, entering large orifices.....	5			7		
Teats, 2-3 inches long, good size, well placed.....				5		
Rudimentaries, four; large, well placed.....	10					
Total.....	100			100		

Iowa State College of Agriculture and the Mechanic Arts.

Scale of points.		Perfect score.
General appearance:		
1. Weight		
2. Form, inclined to be wedge shaped.....		6
3. Quality, hair fine, soft; skin mellow, loose, medium thickness; secretion yellow; bone clean, fine		6
4. Condition, lean, though vigorous appearance when in milk		6
Head and neck:		
5. Muzzle, clean cut; mouth large; nostrils large.....		1
6. Eyes, large, bright, full, mild		1
7. Face, lean, long; expression quiet		1
8. Forehead, broad		1
9. Ears, size medium; inside yellow; texture fine		1
10. Horns, waxy; texture fine		1
11. Neck, fine; length medium; throat clean; dewlap light		1
Fore quarters:		
12. Withers, lean, thin		1
13. Shoulders, light, oblique		2
14. Legs, straight, short; shank fine		2
Body:		
15. Chest, deep, low; girth large, with full fore flank		10
16. Barrel, ribs broad, long, wide apart; stomach large		10
17. Back, lean, straight, open jointed		2
18. Loins, broad		2
19. Navel, large		2
Hind quarters:		
20. Hips, far apart, level		2
21. Rump, long, wide		2
22. Pin bones (or thurls), high, wide apart		1
23. Tail, long, slim; hair in switch fine		1
24. Thighs, thin, long		4
25. Escutcheon, spreading over thighs, extending high and wide; thigh ovals large		2
26. Udder, long, attached high and full behind, extending far in front and full, flexible; quarters even, free from fleshiness		20
27. Teats, large, evenly placed		5
28. Mammary veins, large, long, tortuous, branched with double extension; milk wells large, numerous		5
29. Legs, straight, short; shank fine		2
Total		100

Kansas State Agricultural College.

Scale of points.	Possible score.	Student's score.	Judge's score.
General appearance:			
Form, inclined to be wedge shaped	6		
Quality, hair fine, soft; skin mellow, loose, medium thickness; secretion yellow; bone clean, fine	6		
Temperament, nervous, indicated by lean appearance when in milk	6		
Head and neck:			
Muzzle, clean cut; mouth large; nostrils large	1		
Eyes, large, bright, full, mild	1		
Face, lean, long; expression quiet	1		
Forehead, broad	1		
Ears, size medium; inside yellow; texture fine	1		
Horns, waxy; texture fine	1		
Neck, fine; length medium; throat clean; dewlap light	1		
Fore quarters:			
Withers, lean, thin	1		
Shoulders, light, oblique	2		
Legs, straight, short; shank fine	2		
Body:			
Chest, deep, low; girth large, with full fore flank	10		
Barrel, ribs, broad, long, wide apart; stomach large	10		
Back, lean, straight, open jointed	2		
Loin, broad	2		
Navel, large	2		
Hind quarters:			
Hips, far apart, level	2		
Rump, long, wide	2		
Pin bones (or thurls), high, wide apart	1		
Tail, long, slim; hair in switch fine	1		
Thighs, thin, long	4		
Escutcheon, spreading over thighs, extending high and wide; thigh ovals large	2		
Udder, long, attached high and full behind, extending far in front and full, flexible; quarters even, free from fleshiness	20		
Teats, large, evenly placed	5		
Mammary veins, large, long, tortuous, branched, with double extension; milk wells large, numerous	5		
Legs, straight; shank fine	2		
Total	100		

Agricultural and Mechanical College of Kentucky.

Same as the Kansas card (see above) for dairy cattle.

Maryland Agricultural College.

Scale of points.	Perfect score.	Student's score.	Corrected.
I. Primary considerations—16 points:			
Weight in pounds, estimated, —; corrected, —	3		
Size and substance, for age	4		
Style, attractive, sprightly; breeding apparent	4		
Appearance, wedge-shaped viewed from front, side, rear and above; angular	5		
Quality, skin thin, loose, elastic, mellow; flesh firm; hair soft, fine, silky	16		
II. Nervous energy—23 points:			
Temperament, active, controlled	5		
Eyes, large, clear, bright, mild, placid, free from white	3		
Forehead, broad, high; face dished	3		
Ears, broad, thin, active	2		
Spinal column, long, prominent, open	4		
Milk veins, branching, long, tortuous	4		
Navel, large, defined	2		
	23		
III. Structural anatomy—18 points:			
Contour, clean-cut, smooth, correlated, symmetrical, free from patchiness and offal	2		
Head, medium in size; muzzle refined; mouth large; face lean and long	1		
Neck, fine, flat on side; length medium; throat clean; dewlap light	1		
Withers, narrow on top, spreading; shoulder light, slanting	1		
Back, straight, strong, well muscled	2		
Loin, broad, strong	3		
Pelvic arch, prominent, bare; pin bones high, wide; hips wide, prominent	4		
Flank, high; twist open; thigh thin, incurved	2		
Bones, medium; joints fine, flat; horns small, waxy; tail long, slim	2		
	18		
IV. Digestion and assimilation—23 points:			
Nostrils, medium sized, clear, bright	1		
Breast and brisket, prominent, angular, but not pointed	1		
Chest, wide, deep, long; heart girth large	6		
Barrel, medium long, broad on top, deep, capacious	9		
Ribs, flat, spaced, well sprung; chine open	3		
False ribs, suppressed; barrel depression marked	3		
	23		
V. Milk indications—20 points:			
Udder, long, capacious, balanced, well up behind, free from fleshiness, but with some substance when empty, strongly attached; teats of good size, evenly placed	10		
Escutcheon, spreading over thighs, extending well upward	3		
Milk veins, large, tortuous, long, branched; milk wells large	6		
Skin of ear and udder yellow; secretions yellow, plentiful	1		
	20		
Total	100		
VI. Obvious and deductive defects			
Per cent of perfection			

Massachusetts Agricultural College.

Scale of points.	Per- fect.	Points deficient.	
		Student's score.	Correct score.
A. General appearance—17 points:			
Age, estimated, — years; corrected, — years.....			
Weight, estimated, — pounds; corrected, — pounds.....			
Form, trim, triple wedge shape.....	7		
Quality, hair fine, soft; secretion abundant, yellow; skin mellow, of not more than medium thickness; bone clean, fine.....	5		
Temperament, nervous, indicated by sprightly movements of eye or ear, general refinement, prominence of veins, etc.; not sluggish nor yet wild and restive.....	5		
B. Head and neck—8 points:			
Muzzle, clean cut; mouth and nostrils large.....	1		
Eyes, prominent, clear, mild.....	1		
Face, rather long, lean, fine.....	2		
Forehead, broad, slightly dishing.....	1		
Ears, fine; size medium; secretion rich, yellow.....	1		
Neck, medium long, rather thin, fine at throat.....	2		
C. Fore quarters—6 points:			
Withers, lean; spine high.....	2		
Shoulders, fairly wide at points, light, sloping.....	2		
Brisket, light, thin.....	1		
Legs, short, straight; bone clean, fine.....	1		
D. Body—23 points:			
Chest, deep; girth, — feet; corrected, — feet.....	5		
Ribs, long, broad, open, moderately well sprung.....	2		
Chine, prominent, narrow.....	3		
Barrel, long, deep, capacious.....	8		
Back, straight, open jointed; prominences clearly defined.....	2		
Loin, broad, spare fleshed.....	1		
Flank, deep, thin.....	1		
Navel, large.....	1		
E. Hind quarters—14 points:			
Hips, prominent, wide.....	2		
Rump, level, long; pelvis roomy, wide.....	3		
Thurls, high, wide apart.....	1		
Thighs, long, thin; twist roomy, open.....	4		
Tail, long, rather loosely articulated; bush heavy.....	1		
Legs, straight, well apart, fine boned.....	1		
Escutcheon, high, wide.....	2		
F. Udder and milk veins—32 points:			
Fore udder, broad, well forward, capacious, free from fleshiness.....	10		
Hind udder, broad, well up behind, capacious, free from fleshiness.....	10		
Teats, squarely placed, wide apart, of convenient size, uniform.....	6		
Milk veins, large, long, crooked, extending well forward, branched.....	4		
Milk wells, large or numerous.....	2		
Total.....	100		

Michigan State Agricultural College.

Scale of points.	Per- fect.	Student's estimate.	Corrected.
General appearance:			
Age, estimated, —; corrected, —			
Weight, estimated, — pounds; corrected, — pounds			
Form, wedge-shaped, viewed from front, side, and above	9		
Quality, hair fine; skin soft, medium thickness; bone clean	7		
Temperament, nervous	4		
	20		
Head:			
Muzzle, clean cut; mouth large; nostrils large; face lean, long, dish	2		
Eyes, full, mild, bright	1		
Forehead, broad	1		
Ears, size medium; texture fine	1		
Horn, small at base	1		
	6		
Fore quarters:			
Neck, thin; length medium	2		
Withers, lean, sharp	2		
Shoulders, light, oblique	2		
Legs, short, straight, clean boned	1		
	7		
Body:			
Brisket, thin, sharp	1		
Chest, deep through lungs; girth large, — feet	8		
Ribs, well sprung, broad, far apart	8		
Belly, large, roomy	7		
Chine, large, prominent, open	1		
Back, high, lean	1		
Loin, broad	2		
Flank, deep, thin	1		
Navel, large	2		
	26		
Hind quarters:			
Hips, wide apart	2		
Rump, long, high	2		
Pin bones (or thurls), high, wide apart	1		
Thigh, thin, incurving	4		
Tail, fine, reaching hock	1		
Escutcheon, spreading, high	1		
Udder, long, not fleshy, attached high; quarters even	17		
Teats, large, evenly placed	5		
Milk veins, large, tortuous, branching	4		
Milk wells, large	3		
Legs, short, clean boned, far apart	1		
	41		
Total	100		

College of Agriculture and the Mechanic Arts of the University of Missouri.

Scale of points.	Per- fect.	Student's estimate.	Corrected.
General appearance:			
Age, estimated, —; corrected, —			
Weight, estimated, —; corrected, —			
Form, wedge-shaped, viewed, from front, side, and above	10		
Quality, hair fine; skin soft, of medium thickness; bone fine, clean	5		
Temperament, sanguine, nervous	5		
	20		
Head:			
Muzzle, clean cut; mouth large; nostrils wide, open	1		
Face, lean, long, slightly dished; expression contented	1		
Eyes, full, mild, bright, clear	1		
Forehead, broad, full, high	1		
Ears, size medium; inside yellow; texture fine	1		
	5		
Fore quarters:			
Neck, thin; length medium; throat clean; dewlap small	3		
Withers, lean, sharp	3		
Shoulders, oblique, lean	2		
Chest, deep, wide	3		
Legs, straight, short, clean boned; cannon fine	1		
	12		
Body:			
Girth, large, estimated, —; corrected, —	4		
Ribs, well sprung, long, broad, far apart	4		
Back, high, lean	2		
Vertebra, large; spaces wide, open	2		
Loin, broad, strong	4		
Abdomen, large, deep, showing great capacity	8		
Flank, deep, velvety, thin	2		
Navel, large	1		
	27		
Hind quarters:			
Hips, wide apart, level with back	3		
Rump, long, high, wide; pelvis arching	3		
Pin bones, high, wide apart	2		
Thigh, thin, incurving, well muscled	4		
Fore udder, extending well forward, full, not fleshy; quarters even	6		
Hind udder, attached high behind, full, not fleshy; quarters even	6		
Teats, uniform, good size, well placed	4		
Milk veins, large, elastic, tortuous, branching	3		
Milk wells, large	4		
Legs, clean boned, wide apart, straight; cannon fine	1		
	36		
Total	100		

New Hampshire College of Agriculture and the Mechanic Arts.

Scale of points.	Possible score.	Points deficient.	
		Student's estimate.	Corrected.
A. General appearance:			
Weight, 800 to 1,200 pounds; estimated, — pounds; actual, — pounds.....			
Form, wedge-shaped as viewed from front, side, and top.....	6		
Quality, hair fine, soft; skin mellow, loose, medium thickness; secretion yellow; bones clean.....	6		
Apparent constitution and temperament, rugged, active, intelligent, submissive, yet nervous.....	6		
B. Head:			
Muzzle, clean cut; face lean, long; mouth and nostrils large.....	1		
Eyes, full, mild, expressive, intelligent.....	2		
Forehead, broad, not too wide between the base of horns.....	1		
Ears, size, medium; inside yellow; texture fine.....	1		
C. Fore quarters:			
Neck, thin; length good; throat clean; dewlap light.....	2		
Withers, lean, sharp.....	1		
Shoulders, light, oblique.....	1		
Legs, straight, short; shank fine.....	1		
D. Body:			
Chest, wide through lungs; girth large, — inches.....	5		
Ribs, broad, long, wide apart.....	2		
Stomach, deep; girth large, — inches.....	8		
Back, lean, strong, open jointed, well defined.....	2		
Loin, broad, long; point of hips prominent.....	4		
Flank, low, long from hips down.....	3		
E. Hind quarters:			
Hips, wide apart, — inches.....	4		
Rump, broad, long, tapering.....	4		
Thighs, thin, long, wide apart.....	3		
Tail, slim, fine, reaching hock; switch fine.....	1		
Legs, straight, short, wide apart; shank fine.....	1		
F. Udder:			
Front udder, carried well forward, full but not fleshy; quarters even.....	12		
Hind udder, carried well back, attached high, good width, full but not fleshy, quarters even.....	10		
Teats, good, uniform in size, properly placed.....	4		
Milk veins, large, long, extending well forward, crooked in their course.....	6		
Milk wells, large.....	2		
Ecutcheon, high, wide, spreading over thighs; thigh ovals large.....	1		
Total	100		

New Mexico College of Agriculture and Mechanic Arts.

Scale of points.		Perfect score.
A. General appearance:		
1. Weight, 800 to 1,000 pounds, estimated. — pounds; actual, — pounds		6
2. Form, wedge-shaped as viewed from front, side, and top		6
3. Quality, hair fine, soft; skin mellow, loose, medium thickness secretion yellow; bone clean		6
4. Temperament, nervous, indicated by lean appearance		6
B. Head and neck:		
5. Muzzle, clean cut; mouth large; nostrils large		1
6. Eyes, large, bright, full, mild		1
7. Face, lean, long; expression quiet		1
8. Forehead, broad		1
9. Ears, size medium; inside yellow; texture fine		1
10. Horns, fine; texture waxy		1
11. Neck, fine; length medium; throat clean; dewlap light		1
C. Fore quarters:		
12. Withers, lean, thin		1
13. Shoulders, light, oblique		2
14. Legs, straight, short; shank fine		2
D. Body:		
15. Chest, deep, low; girth large with full fore flank		10
16. Barrel, ribs broad, long, wide apart; stomach large		10
17. Back, lean, straight, open jointed, well defined		2
18. Loin, broad		2
19. Naval, large		2
E. Hind quarters:		
20. Hips, far apart, level		2
21. Rump, long, broad		2
22. Pin bones (or thurls), high, wide apart		1
23. Tail, long, slim; hair in switch fine		1
24. Thighs, thin, long, wide apart		4
25. Escutcheon, spreading over thighs, extending high and wide; thigh ovals large		2
26. Udder, long, broad, flexible; quarters even, free from fleshiness; front udder carried well forward, full; hind udder carried well back, attached high, full		20
27. Teats, large, evenly placed		5
28. Milk veins, large, long, tortuous		3
29. Milk wells, large		2
30. Legs, straight; shank fine		2
Total		100

Cornell University.

Scale of points.	Perfect score.	Points deficient.	
		Student's estimate.	Corrected.
General appearance:			
Weight, estimated, — pounds; actual, — pounds.....	5		
Form, wedge-shaped as viewed from front, side, and top.....	5		
Quality, hair fine, soft; skin mellow, loose, medium thickness secretion yellow; bone clean.....	8		
Constitution, vigorous, not inclined to beefiness.....	8		
Head and neck:			
Muzzle, clean cut; mouth large; nostrils large.....	1		
Eyes, large, bright.....	1		
Face, lean, long; expression quiet.....	1		
Forehead, broad, slightly dished.....	1		
Ears, size medium; inside yellow; texture fine.....	1		
Neck, fine; length medium; throat clean; dewlap light.....	2		
Fore and hind quarters:			
Withers, lean, thin.....	1		
Shoulders, light, oblique.....	2		
Hips, far apart; level between hooks.....	2		
Rump, long, wide.....	2		
Pin bones (or thurls), high, wide apart.....	1		
Thighs, thin, long.....	2		
Legs, straight, short; shank fine.....	1		
Tail, long, slim; switch fine.....	1		
Body:			
Chest, deep, low; girth large.....	8		
Ribs, broad, well sprung, long, wide apart; stomach large.....	5		
Back, lean, straight; chine open.....	8		
Loin, broad, level.....	2		
Flank, moderately low.....	1		
Navel, large.....	1		
Milk secreting organs:			
Udder, long, attached high and full behind, extending far in front and full; quarters even.....	15		
Udder, capacious, flexible; skin loose, pliable, covered with short, fine hair.....	13		
Teats, large, evenly placed.....	4		
Milk veins, large, tortuous; milk wells large.....	6		
Escutcheon, spreading over thighs, extending high and wide; thigh ovals large.....	2		
Total	100		

North Dakota Agricultural College.

Scale of points.	Perfect score.	Points deficient.	
		Student's score.	Corrected.
General appearance:			
Weight, estimated, — pounds; actual, — pounds.....			
Form, wedge-shaped, as viewed from front, side, and top; weight 800 to 1,000 pounds.....	8		
Quality, hair fine, soft; skin mellow, loose, medium thickness, secretion yellow; bone clean.....	8		
Temperament, nervous, indicated by lean appearance.....	5		
Head and neck:			
Muzzle, clean cut; mouth large; nostrils large.....	1		
Eyes, large, bright.....	1		
Face, lean, long; expression quiet.....	1		
Forehead, broad, full.....	2		
Ears, size medium; inside yellow; texture fine.....	1		
Neck, fine; length medium; throat clean; dewlap light.....	2		
Fore quarters:			
Withers, lean, thin.....	1		
Shoulders, light, oblique.....	2		
Legs, straight, short; shank fine.....	3		
Body:			
Chest, deep, low; girth large.....	8		
Ribs, broad, long, wide apart; stomach large.....	10		
Back, lean, straight, open jointed.....	3		
Loins, broad.....	3		
Naval, large.....	2		
Hind quarters:			
Hips, far apart.....	2		
Rump, long, wide.....	2		
Pin bones (or thurls), high, wide apart.....	1		
Tail, long, slim; switch fine.....	1		
Thighs, thin, long.....	2		
Escutcheon, spreading over thighs, extending high and wide; thigh ovals large.....	2		
Udder, long, attached high and full behind, extending far in front and full; quarters even, free from fleshiness.....	16		
Teats, large, evenly placed.....	4		
Milk veins, large, tortuous; milk wells large.....	6		
Legs, straight, far apart; shank fine.....	3		
Total	100		

North Carolina College of Agriculture and the Mechanic Arts.

Same as the New Hampshire card (see p. 67) for dairy cattle.

The College of Agriculture and Domestic Science, Ohio State University.

Scale of points.	Score.					
	Male.			Female.		
	Standard.	Student's.	Corrected.	Standard.	Student's.	Corrected.
A. General appearance:						
Weight, estimated, — pounds; actual, — pounds.....	1	.....		1	.....	
Form, wedge shape from front, side, and top.....	10	.....		7	.....	
Form, shapely, masculine, medium long.....	10	.....		8	.....	
Quality, hair fine, silky; skin mellow, loose, medium thick, yellow, not fleshy; bone fine.....	10	.....		8	.....	
B. Head and neck:						
Muzzle, broad; nostrils large.....	1	.....		1	.....	
Eyes, of good size, mild, bright.....	2	.....		1	.....	
Face, lean, fine, shapely.....	1	.....		1	.....	
Forehead, broad.....	2	.....		2	.....	
Ears, not coarse; size medium; inside yellow.....	1	.....		1	.....	
Neck, fine, rather long, well set on shoulders and head; topline slightly curved; throat clean; dewlap light.....	2	.....		2	.....	
Neck, neatly joined to head and shoulders, of good length, masculine and strong of bearing; nearly free of dewlap.....	5	.....			.....	
C. Fore quarters:						
Weight, — pounds.....		.....			.....	
Withers, lean, thin.....	2	.....		1	.....	
Withers, well rounded, even on top.....	4	.....		2	.....	
Shoulders, light, oblique.....	2	.....		2	.....	
Legs, straight, short; shank fine; feet well placed.....		.....			.....	
D. Body:						
Chest, deep, low, full; girth large, — inches.....	10	.....		8	.....	
Crops, not deeply depressed.....	3	.....		1	.....	
Ribs, long, broad, well sprung, wide apart.....	5	.....		5	.....	
Back, lean, strong, well defined.....	3	.....		2	.....	
Stomach, deep; girth large, — inches.....	3	.....		3	.....	
Loin, broad, long, level; last rib to hip, — inches.....	5	.....		4	.....	
Flanks, low, deep from hip down.....	2	.....		1	.....	
E. Hind quarters:						
Weight, — pounds.....		.....			.....	
Hips, wide apart females; not too wide bulls.....	3	.....		3	.....	
Rumps, broad, level; long, — inches.....	3	.....		3	.....	
Pin bones (or thurls), high, wide apart.....	1	.....		1	.....	
Thighs, thin, roomy, long, well carried.....	3	.....		3	.....	
Legs, straight, short, wide apart; shank fine.....	2	.....		2	.....	
Tail, long, fine, reaching hocks; switch good.....	1	.....		1	.....	
F. Udder or rudimentaries:						
Front udder, carried well forward, full, thick, soft, mellow within; quarters even.....		.....		12	.....	
Hind udder, full in form, well up behind, good width, mellow, even.....		.....		10	.....	
Milk veins, large, long, elastic, tortuous.....	5	.....		6	.....	
Milk wells, large.....		.....		2	.....	
Teats, $2\frac{1}{2}$ to 3 inches long, good size, well placed.....		.....		4	.....	
Rudimentaries, four; large, well placed.....	10	.....			.....	
Total.....	100	.....		100	.....	

NOTE.—A defective teat or udder disqualifies. Matured males should weigh from 1,000 to 2,000 pounds; females, 750 to 1,400 pounds.

Oklahoma Agricultural and Mechanical College.

Scale of points.	Possible score.	Name of animals.			
General appearance—20 points:					
Weight, estimated, — pounds; actual, — pounds					
Form, wedge shape, as viewed from front and top; top line straight; great depth of barrel	5				
Quality, hair fine, soft; skin mellow, loose, medium thickness, secretion yellow; bone clean	8				
Style, active, vigorous, showing strong character; temperament inclined to nervousness, but not irritable or vicious	7				
Head and neck—8 points:					
Muzzle, broad, clearly defined; mouth and nostrils large	1				
Eyes, large, prominent, clear, placid	1				
Face, lean, somewhat long, fine between muzzle and eyes	1				
Forehead, broad, full	2				
Ears, texture fine; size medium; inside yellow	1				
Neck, fine; length medium; throat clean; dewlap light	2				
Fore quarters—4 points:					
Withers, lean, sharp	1				
Shoulder, light, oblique	2				
Legs, straight, short; shank fine	1				
Body—26 points:					
Chest, deep, low; girth large; fore flank full	10				
Barrel, ribs broad, long, wide apart; stomach large	10				
Back, lean, straight, opened jointed	3				
Loin, broad	2				
Navel, large	1				
Hind quarters—42 points:					
Hips, far apart	3				
Rump, long, wide	3				
Pin bones (or thurls), wide apart	1				
Tail, long, slim; switch fine	1				
Thighs, thin, long, wide apart	4				
Escutcheon, spreading over thighs, extending high and wide; thigh ovals large	1				
Legs, straight; shank fine	3				
Udder, long, attached high and full behind, extending far in front and full; quarters even, free from fleshiness	18				
Teats, large, evenly placed, cylindrical	4				
Mammary veins, large, tortuous, branching; milk wells large	4				
Total	100				

Oregon State Agricultural College.

Scale of points.	Possible score.	Student's estimate.	Corrected.
A. General appearance:			
Weight, 800 to 1,200 pounds; estimated, — pounds; actual, — pounds			
Form, wedge shape, as viewed from front and top	8		
Quality, hair fine, soft; skin mellow, loose, medium thickness; secretion yellow; bone clean	8		
Temperament, nervous, indicated by lean appearance	5		
B. Head and neck:			
Muzzle, clean cut; mouth large; nostrils large	1		
Eyes, full, mild, bright	1		
Face, lean, long; expression quiet	1		
Foreshead, moderately broad, full	2		
Ears, size medium; inside yellow; texture fine	1		
Neck, fine; length medium; throat clean; dewlap light	2		
C. Fore quarters:			
Withers, lean, thin	1		
Shoulders, light, oblique	2		
Legs, straight, short; shank fine	3		
D. Body:			
Chest, deep, low; girth large	8		
Ribs, broad, long, wide apart; stomach large	10		
Back, lean, straight, open jointed	3		
Loin, broad	3		
Flank, low	1		
Navel, large	2		
E. Hind quarters:			
Hips, far apart, level between hooks	2		
Rump, long, wide	2		
Pin bones (or thurls), high, wide apart	1		
Tail, long, slim; switch fine	1		
Thighs, thin, long	2		
Escutcheon, spreading over thighs, extending high and wide; thigh ovals large	2		
Udder, long, attached high and full behind, extending far in front and full; quarters even, free from fleshiness	15		
Teats, large, evenly placed	4		
Mammary veins, large, tortuous	3		
Milk wells, large	3		
Legs, straight, far apart; shank fine	3		
Total	100		

The Pennsylvania State College.

Scale of points.	Perfect.	Student's estimate.	Corrected.
General appearance:			
Age, estimated, —; corrected, —.....			
Weight, estimated, — pounds; corrected, — pounds.....			
Form, wedge-shaped viewed from front, side, and above.....	8		
Quality, hair fine; skin soft, of medium thickness; bone fine, clean.....	6		
Temperament, sanguine, nervous.....	6		
	20		
Head:			
Muzzle, clean cut; mouth large; nostrils wide, open.....	1		
Face, lean, long, slightly dished; expression contented.....	1		
Eyes, full, mild, bright, clear.....	1		
Forehead, broad, high.....	1		
Ears, size medium; inside yellow; texture fine.....	1		
	5		
Fore quarter:			
Neck, thin; length medium; throat clean; dewlap small.....	2		
Withers, lean, sharp.....	2		
Shoulders, oblique, lean.....	1		
Chest, deep, wide.....	3		
Legs, straight, short, clean boned; cannon fine.....	1		
	9		
Body:			
Girth, large, estimated, — feet; corrected, — feet.....	4		
Ribs, well sprung, long, broad, far apart.....	4		
Back, high, lean.....	2		
Vertebra, large; spaces wide, open.....	2		
Loin, broad, strong.....	4		
Abdomen, large, deep, showing great capacity.....	8		
Flank, deep, velvety, thin.....	1		
Navel, large.....	1		
	26		
Hind quarter:			
Hips, wide apart, level with back.....	3		
Rump, long, high, wide; pelvis arching.....	3		
Pin bones, high, wide apart.....	2		
Thigh, thin, incurving, well muscled.....	4		
Fore udder, extending well forward, full, not fleshy; quarters even.....	8		
Hind udder, attached high behind, full, not fleshy; quarters even.....	8		
Teats, uniform, good size, well placed.....	4		
Milk veins, large, elastic, tortuous, branching.....	3		
Milk wells, large.....	4		
Legs, clean boned, wide apart, straight; cannon fine.....	1		
	40		
Total	100		

South Dakota Agricultural College.

Same as the Iowa card (see p. 61) for dairy cattle.

State Agricultural and Mechanical College of the University of Tennessee.

Scale of points.	Possible score.	Student's score.
A. General appearance:		
1. Weight, 800 to 1,000 pounds; estimated, — pounds; actual, — pounds	6	
2. Form, wedge-shaped as viewed from front, top, side, back, and rear	6	
3. Quality, hair, fine, soft; skin of medium thickness, mellow, elastic; secretion yellow; bone, fine, clean	4	
4. Temperament, sanguine	4	
5. Constitution, vigorous, robust, showing size and substance	5	
B. Head and neck:		
6. Muzzle, clean cut; mouth large; nostrils large	1	
7. Eyes, full, clear, placid	1	
8. Face, lean and long; expression quiet	1	
9. Forehead, broad, high, full	2	
10. Ears, texture fine; size medium	1	
11. Neck, fine; length of neck medium; throat clean; dewlap light	2	
C. Fore quarters:		
12. Withers, lean, thin	1	
13. Shoulders, light, slanting	2	
14. Legs, straight, short; shank fine	3	
D. Body:		
15. Chest, deep, low; girth large	8	
16. Ribs, broad, long, wide apart; stomach large	10	
17. Back, lean, straight; vertebrae spaced	3	
18. Loin, broad, muscular	3	
19. Flank, thin, arching	1	
20. Navel, large, well-defined	2	
E. Hind quarters:		
21. Hips, wide; space between hooks level	2	
22. Rump, long, wide	2	
23. Pin bones, high, wide apart	1	
24. Tail, long, fine; switch fine	1	
25. Thighs, long, thin	2	
26. Escutcheon, spreading over thighs, extending far upward	2	
27. Udder, long, capacious, but not pendulous, extending well up behind and far forward; quarters, even, free from fleshiness	15	
28. Teats, large, evenly placed	4	
29. Milk veins, large, long, tortuous	3	
30. Milk wells, large	3	
31. Legs, straight, set well apart; shank fine	3	
Total	100	

State Agricultural and Mechanical College of the University of Tennessee.

Scale of points.	Perfect score.	Student's score.
I. Primary considerations:		
1. Weight, — pounds		
2. Size and substance, forage	3	
3. Style, attractive, sprightly; breeding apparent	4	
4. Appearance, wedge-shaped, angular	4	
5. Quality, skin thin, loose, elastic, mellow; flesh firm; hair soft, fine, silky	5	
II. Nervous energy:		
6. Temperament, active, controlled	5	
7. Eyes, large, clear, bright, mild, placid, free from white	6	
8. Forehead, broad, high; face dished	3	
9. Ears, broad, thin, active	2	
10. Spinal column, long, prominent, open	4	
11. Milk veins, branching, long, tortuous	4	
12. Navel, large, defined	2	
III. Structural anatomy:		
13. Contour, clean-cut, smooth, correlated, symmetrical, free from patchiness and offal	2	
14. Head, medium in size; muzzle refined; mouth large; face lean, long	1	
15. Neck, fine; length medium; flat on side; throat clean; dewlap light	1	
16. Withers, narrow on top, spreading; shoulder light, slanting	1	
17. Back, straight, strong, well muscled	2	
18. Loin, broad, strong	3	
19. Pelvic arch, prominent, bare; pin bones high, wide	2	
20. Flank, high; twist open; thigh thin, incurved	1	
21. Bones, medium; joints fine, flat; horns small, waxy; tail long, slim	2	
IV. Digestion and assimilation:		
22. Nostrils, medium-sized, clear, bright	1	
23. Breast and brisket, prominent, angular	1	
24. Chest, wide, deep, long; girth large	8	
25. Barrel, medium long, broad on top, deep, capacious	9	
26. Ribs, flat, spaced, well sprung; chine open	3	
V. Milk indications:		
27. False ribs, suppressed; barrel depression marked	3	
28. Udder, long, capacious, balanced, free from fleishiness, strongly attached, collapsed when empty; teats evenly placed	8	
29. Escutcheon, spreading over thighs, extending well upward	3	
30. Milk veins, large, tortuous, long, branched; milk wells large	6	
31. Skin of ear and udder yellow; secretions yellow	1	
Total	100	

Agricultural and Mechanical College of Texas.

Scale of points.	Possible score.	Student's score.	Corrected.
A. General appearance:			
Weight, 800 to 1,000 pounds, estimated, — pounds			
Form, wedge-shaped as viewed from front, top, and back	8		
Quality, hair fine, soft; skin of medium thickness, mellow, elastic; secretion yellow; bone fine, clean	8		
Temperament, sanguine	5		
B. Head and neck:			
Muzzle, clean cut; mouth large; nostrils large	1		
Eyes, full, mild, bright	1		
Face, lean, long; expression quiet	1		
Forehead, broad, high, full	2		
Ears, texture fine; size medium	1		
Neck, fine; length of neck medium; throat clean; dewlap light	2		
C. Fore quarters:			
Withers, lean, thin	1		
Shoulders, light, slanting	2		
Legs, straight, short; shank fine	3		
D. Body:			
Chest, deep, low; girth large	8		
Ribs, broad, long, wide apart; stomach large	10		
Back, lean, straight, open jointed	3		
Loin, broad	3		
Flank, low	1		
Navel, large	2		
E. Hind quarters:			
Hips, far apart; space between hooks level	2		
Rump, long, wide	2		
Pin bones, high, wide apart	1		
Tail, long, fine; switch fine	1		
Thigh, long, thin	2		
Escutcheon, spreading over thighs, extending far upwards	2		
Udder, long, capacious, but not pendulous, extending well up behind and far forward; quarters even, free from fleshiness	15		
Teats, large, evenly placed	4		
Milk veins, large, long, tortuous	3		
Milk wells, large	3		
Legs, straight, set well apart; shank fine	3		
Total	100		

Agricultural College of Utah.

Scale of points.	Score.					
	Male.			Female.		
	Standard.	Student's.	Corrected.	Standard.	Student's.	Corrected.
A. General appearance:						
Age, estimated, —; corrected, —				1		
Weight, estimated, — pounds; actual, — pounds						
Form, wedge shaped as viewed from front, side, and top				8		
Form, shapely, masculine, medium height	8					
Quality, hair fine, silky; skin mellow, loose, medium thickness; secretions yellow; bone clean; horns small at base	7			7		
Temperament, nervous, indicated by lean appearance	4			4		
B. Head and neck:						
Muzzle, clean cut; mouth large, broad; nostrils large	1			1		
Eyes, large, bright, full, placid	2			2		
Face, lean, long; expression quiet	1			1		
Forehead, full above, broad, slightly dishd between the eyes; not too wide between the horns	2			1		
Ears, well set; size medium; inside yellow; texture fine	1			1		
Neck, fine, but joining strong at head, rather long; throat clean; dewlap light				2		
Neck, neatly joined to head and shoulders, of good length; masculine and strong of bearing; nearly free of dewlap	3					
C. Fore quarters:						
Withers, lean, thin				1		
Withers, well rounded, even on top	2					
Shoulders, lean, strong, oblique	4			2		
Legs, straight, short; shanks fine; hoofs broad, sloping	1			1		
D. Body:						
Chest, deep, low, full; girth large; brisket light, thin	8			8		
Ribs, broad, long, well sprung, wide apart	3			3		
Stomach (or belly), large, deep, roomy	8			8		
Back, fairly level, not too straight, standing out well; spine large, lean, open-jointed	3			2		
Loin, broad, lean	5			2		
Flank, moderately low, thin	2			1		
Navel, large, prominent	3			1		
E. Hind quarters:						
Hip, wide apart, arched between	2			2		
Rump, long, wide, arched, not fleshy	2			3		
Pin bones (or thurls), high, wide apart	1			1		
Thighs, long, thin, incurved, giving room for udder	4			2		
Legs, straight, short, wide apart; shanks fine	2			2		
Tail, long, slim, reaching to hocks; switch fine	1			1		
F. Udder and rudimentaries (milk-secreting organs):						
Udder, long, attached high and full behind, extending far in front and full; quarters even				12		
Udder, capacious, flexible; skin loose, pliable, covered with short, fine hair; some substance in structure, but not fleshy				7		
Teats, size and length, medium; evenly placed, wide apart				5		
Rudimentaries, four; large, well placed	10					
Milk veins, large, long, tortuous; entering large orifices, which are well forward	5			6		
Escutcheon, spreading over thighs; extending high and wide; thigh ovals large	5			8		
Total	100			101		

Virginia Agricultural and Mechanical College and Polytechnic Institute.

Same as the Iowa card (see p. 61) for dairy cattle

Washington Agricultural College and School of Science.

Scale of points.	Perfect.	Student's score.	Corrected score.
General appearance—21:			
Weight, estimated, — pounds; actual, — pounds			
Age, estimated, —; actual, —			
Form, wedge shaped, as viewed from front, side, and above	10		
Quality, hair fine; skin soft, medium thickness; bone clean	5		
Temperament, nervous	6		
Head—7:			
Muzzle, clean cut; mouth large; nostrils large	1		
Face, lean, long, dishing	2		
Eyes, full, mild, bright	1		
Forehead, broad; horns small at base	2		
Ears, size medium; inside yellow; texture fine	1		
Fore quarters—9:			
Neck, thin; length medium	2		
Withers, sharp, lean	3		
Shoulders, light, oblique	1		
Legs, short, straight, fine shanked	2		
Brisket, thin, sharp	1		
Body—25:			
Chest, deep; girth at heart large (— feet, — inches)	7		
Ribs, broad, long, far apart	8		
Belly, large, roomy	7		
Back, lean, straight, open-jointed	3		
Loin, broad	2		
Flank, deep	2		
Navel, large	1		
Hind quarters—88:			
Hips, far apart, level between them	3		
Rump, long, high	2		
Pin bones, high, wide apart	1		
Tail, long, reaching hocks; switch finely developed	1		
Thighs, thin, incurving	2		
Escutcheon, wide, extending far up	1		
Udder, extending far up behind and far in front; quarters even, free from fleshiness	16		
Teats, well shaped, neither too large nor too small; evenly placed	5		
Milk veins, large, tortuous	3		
Milk wells, large	2		
Legs, straight, far apart; shank fine	2		
Total	100		

Washington Agricultural College and School of Science.

Scale of points.	Perfect.	Student's score.
I. Digestive apparatus:		
1. Abdomen, deep, wide, giving triangular form, as seen from side and top view; ribs well arched (not dropping too soon after leaving backbone).....	20	.....
2. Muzzle and jaw, large, showing eating capacity	5	.....
	25	.....
II. Temperament:		
1. Thighs, thin, incurving.....	4	.....
2. Hips, wide, prominent, but strong	3	.....
3. Backbone, well developed, not too deeply covered with flesh	3	.....
4. Legs, short, small, thin skinned	4	.....
5. Shoulders, light, with sharp rather than round withers	4	.....
6. Brisket, V-shaped rather than U-shaped	2	.....
7. Neck, not fleshy	2	.....
8. Skull, wide in region of brain, showing large brain	3	.....
	25	.....
III. Constitution:		
1. Chest, deep, wide; fore legs not close together; nostrils wide, flaring; these points indicate large lungs and heart.....	8	.....
2. Pelvic bones, large; rump prominent, clear to base of tail; tail long; switch well developed	7	.....
3. Eyes, bright; skin soft, pliant; hair smooth, glossy; all indicating health and vigor	5	.....
	20	.....
IV. Milk organs:		
1. Udder, large, lower outline a semicircle when distended; attachment to body long, extending far up behind and far out in front; plenty of glandular tissue within, but showing loose folds behind when empty; quarters even	12	.....
2. Teats, good size, well shaped, easy to milk, not too close together	5	.....
3. Milk veins, large, tortuous; veins on udder prominent (escutcheon wide, regular, extending far up(?))	8	.....
4. Hips and loins, wide; legs far apart, giving room for large udder.....	5	.....
	30	.....
Total.....	100	.....
V. Training:		
1. Flow, constant, regular till near calving, having been milked, fed regularly, and never allowed to nurse calf more than a few days.....	50	.....
2. No vicious habits such as kicking, hooking, jumping, etc.....	50	.....
	100	.....
Total.....	200	.....

College of Agriculture of the University of Wisconsin.

Scale of points.	Possible score.	Points deficient.	
		Student's score.	Corrected.
General appearance—17 points:			
Weight, estimated, — pounds.....	5		
Form, wedge shaped as viewed from front, side, and top.....	4		
Quality, hair fine, soft; skin mellow, loose, medium thickness; secretion yellow; bone clean, fine.....	8		
Temperament, nervous, indicated by marked refinement in head, neck, and fore quarters; backbone prominent, well defined.....			
Head and neck—13 points:			
Muzzle, clean cut; mouth large; nostrils wide.....	2		
Eyes, large, bright, full.....	2		
Face, refined, long; expression quiet.....	2		
Forehead, broad, slightly dishing.....	2		
Ears, size medium; inside yellow; texture fine.....	1		
Neck, fine, thin; length medium; throat clean; dewlap light.....	4		
Fore quarters—7 points:			
Shoulders, light, sloping, backbone rising well between the blades.....	4		
Breast, pointed; brisket light.....	2		
Legs, straight, short; shank fine.....	1		
Body—20 points:			
Chest, deep; foreflank full.....	5		
Barrel, large; ribs broad, deep, wide apart.....	9		
Back, straight, strong; prominences clearly defined.....	3		
Loin, broad; coupling roomy.....	3		
Hind quarters—15 points:			
Hips, far apart, prominent, level with the back.....	2		
Rump, long, wide; pelvis roomy.....	5		
Tail, well set, long, tapering; switch heavy.....	1		
Thighs, thin, long, wide apart; twist very open.....	5		
Legs, straight, far apart; shank fine.....	1		
Escutcheon, spreading over thighs, extending high and wide; thigh ovals large.....	1		
Milk organs—28 points:			
Udder, symmetrical, broad, extending well forward and well up between thighs, free from fleshiness, well held up; quarters even in size.....	18		
Teats, good size, evenly placed.....	4		
Milk veins, large, tortuous, branching; milk wells large, numerous.....	6		
Total.....	100		

HOGS.

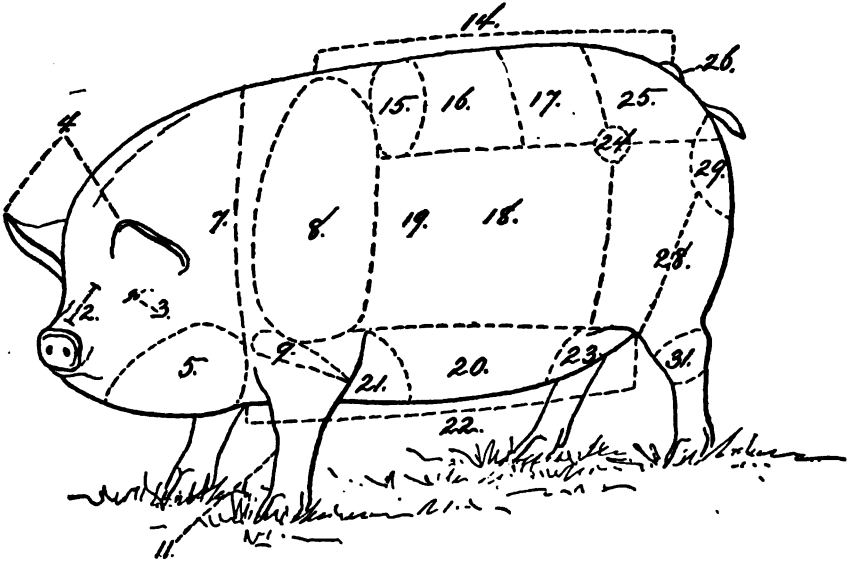


FIG. 6.—Points of the hog, three-quarters front view.

- | | | | |
|------------------------------------|--------------|------------------------------------|--------------|
| 2. Face. | 9. Arm. | 19. Ribs. | 25. Rump. |
| 3. Eye. | 11. Leg. | 20. Belly. | 26. Tail. |
| 4. Ears. | 14. Topline. | 21. Fore flank. | 28. Thigh. |
| 5. Jowl. | 15. Crops. | 22. Underline, or bot-
tomline. | 29. Buttock. |
| 7. Shoulder vein, or neck
vein. | 16. Back. | 23. Hind flank. | 31. Hock. |
| 8. Shoulder. | 17. Loin. | 24. Hip. | |
| | 18. Side. | | |

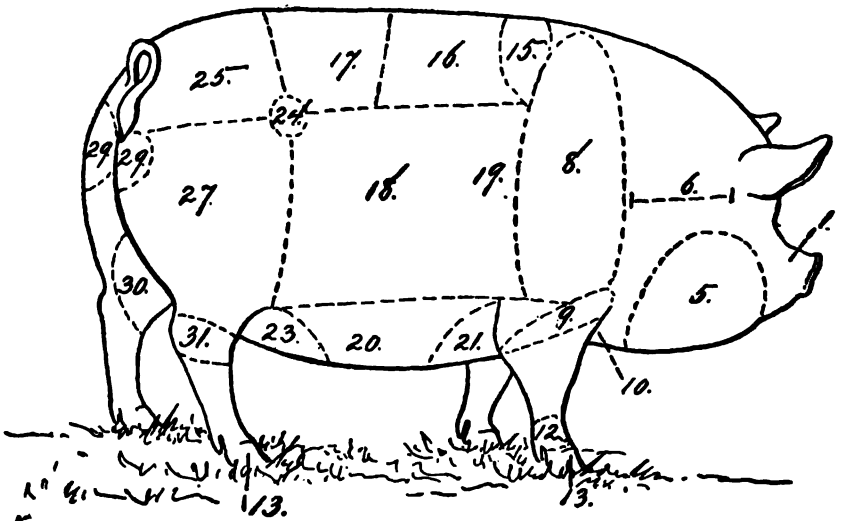


FIG. 7.—Points of the hog, side view.

- | | | | |
|-------------------------|--------------|-----------------|-----------------------|
| 1. Snout. | 12. Pastern. | 19. Ribs. | 27. Ham, or gammon. |
| 5. Jowl. | 13. Feet. | 20. Belly. | 29. Buttocks. |
| 6. Neck. | 15. Crops. | 21. Fore flank. | 30. Twist, or crotch. |
| 8. Shoulder. | 16. Back. | 23. Hind flank. | 31. Hock. |
| 9. Arm. | 17. Loin. | 24. Hip. | |
| 10. Breast, or brisket. | 18. Side. | 25. Rump. | |

Alabama Polytechnic Institute.

Scale of points.	Possible score.	Student's score.	Judge's score.
General appearance:			
Weight, score according to age	6		
Form, deep, broad, low, long, symmetrical, compact, standing squarely on legs	8		
Quality, hair silky; skin fine; bone fine; flesh smooth, mellow, free from lumps or wrinkles	8		
Condition, deep, even covering of flesh, especially in region of valuable cuts	8		
Objections, scurfy, coarse or wrinkly skin; hair coarse, bristly; bone coarse; unequal development of parts.			
Head and neck:			
Snout, length medium; not coarse	1		
Eyes, full, mild, bright, well set	1		
Face, short, cheeks full	1		
Ears, fine; size medium; soft	1		
Jowl, strong, neat, broad	1		
Neck, thick; length medium	1		
Objections, face, long, narrow, straight; narrow between eyes; jowl flabby, pendant; neck tucked up.			
Fore quarters:			
Shoulder, broad, deep, full, compact on top, same width as back and hind quarters	6		
Breast, moderately wide, full	2		
Legs, straight, strong, short; bone clean; pasterns upright; feet medium size	2		
Objections, weak knees and pasterns; legs close together, crooked; shoulders narrow, shallow.			
Body:			
Chest, deep, broad; girth full	4		
Sides, deep, long, full; ribs close, well sprung	6		
Back, broad, straight, uniform width, thickly and evenly fleshed.	11		
Loin, wide, thick, straight	10		
Belly, straight, even; flank well let down	4		
Objections, depression behind shoulders; girth small; loin narrow; back drooping; belly narrow.			
Hind quarters:			
Hips, wide apart, smooth	2		
Rump, long, wide, evenly fleshed, straight	2		
Ham, heavily fleshed, plump, full, deep, wide	10		
Thigh, fleshed close to hocks, full in crotch	2		
Legs, straight, strong, short; bone clean; pasterns upright; feet medium size	2		
Tail, well set on; size medium; curled	1		
Objections, hips and rump narrow; rump short, steep; ham and thigh thin and shallow.			
Total	100		

Kansas State Agricultural College.

	Possible score.	Student's score.	Judge's score.
1. Head	4		
2. Eyes	2		
3. Ears	2		
4. Neck	2		
5. Jowl	2		
6. Shoulders	6		
7. Chest	12		
8. Back and loins	14		
9. Sides and rib	10		
10. Belly and flank	4		
11. Ham and rump	10		
12. Feet and legs	10		
13. Tail	1		
14. Coat	3		
15. Color	3		
16. Size	6		
17. Action and style	3		
18. Condition	2		
19. Disposition	2		
20. Symmetry	3		
Total	100		

Michigan State Agricultural College.

Scale of points.	Perfect.	Student's estimate.	Corrected.
General appearance:			
Weight, estimated, — pounds; actual, — pounds			
Size, according to age and breed	6		
Form, deep, low down, broad; standing firmly and squarely on legs	8		
Quality, bone clean, medium fineness; hair silky, without bristles	8		
Disposition, quiet	5		
	27		
Head and neck:			
Snout, length medium	1		
Eyes, prominent, clear, bright	1		
Face, short; cheeks prominent	1		
Ears, fine, silky; size medium	1		
Jowl, large, neat, full to brisket and shoulder	1		
Neck, short, thick, broad on top	2		
	7		
Fore quarters:			
Shoulder, broad, deep, compact, full	9		
Breast, moderately projecting, wide, deep	3		
Legs, straight, short, well placed outside	3		
Feet, strong; standing well on the toes	3		
	18		
Body:			
Girth, large	2		
Chest, deep, wide, thick through the heart	5		
Side, close ribbed, long, deep, full	8		
Back, broad, straight, thick fleshed	5		
Loin, broad, thick, even	3		
Belly, wide; bottomline straight	2		
Flank, low, continuing bottomline	2		
	27		
Hind quarters:			
Hips, wide apart, smooth	3		
Rump, long, broad, even, full	3		
Hams, thickly fleshed, broad, long, fleshed low down	9		
Legs, straight, short, well placed outside	3		
Feet, strong; standing well upon toes	3		
	21		
Total	100		

College of Agriculture and Mechanic Arts of the University of Missouri.

Scale of points.	Perfect.	Student's estimate.	Corrected.
General appearance:			
Weight, estimated, — pounds; actual, — pounds			
Size, according to age	6		
Form, deep, low down, broad; standing firmly and squarely on legs	7		
Quality, bone clean, medium fineness; hair silky, without bristles	8		
Disposition, quiet	5		
	26		
Head and neck:			
Snout, length medium	1		
Eyes, prominent, clear, bright	1		
Face, short; cheeks prominent	1		
Ears, fine, silky; size medium	1		
Jowl, large, neat, full to brisket and shoulder	1		
Neck, short, thick, broad on top	2		
	7		
Fore quarters:			
Shoulder vein, full	2		
Shoulder, broad, deep, compact	8		
Breast, moderately projecting, wide, deep	8		
Legs, straight, short, strong, well placed outside	6		
	19		
Body:			
Girth, large, — feet, — inches	2		
Chest, deep, wide	5		
Sides, close ribbed, long, deep, full	8		
Back, broad, straight, thick fleshed	5		
Loin, broad, thick, even	3		
Belly, wide; bottom line straight	2		
Flank, low, continuing bottom line	2		
	27		
Hind quarters:			
Hips, wide apart, smooth	8		
Rump, long, broad, even, full	3		
Hams, thickly fleshed, broad, long, fleshed low down	9		
Legs, straight, short, strong, well placed outside	6		
	21		
Total	100		

New Hampshire College of Agriculture and the Mechanic Arts.

Scale of points.	Perfect score.	Points deficient.	
		Student's score.	Corrected.
A. General appearance:			
Weight, estimated, — pounds; actual, — pounds			
Score, according to age	6		
Form, deep, broad, low, symmetrical, compact; standing squarely on legs	8		
Quality, bone clean; hair silky; skin fine	8		
Disposition, quiet	5		
B. Head and neck			
Snout, length medium; not coarse	1		
Eyes, full, mild, bright, large	1		
Face, short; cheeks full	1		
Ears, fine, soft; size medium	1		
Jowl, strong, neat, broad	1		
Neck, thick; length medium	1		
C. Fore quarters:			
Shoulder vein, full	1		
Shoulder, broad, deep, full, compact on top	8		
Breast, advanced, wide	2		
Legs, straight, short, strong; feet medium size	4		
D. Body:			
Chest, deep, broad; girth large	10		
Sides, deep, lengthy, closely ribbed	8		
Back, broad, straight, thickly and evenly fleshed	4		
Loin, wide, thick	3		
Belly, straight	2		
Flank, even with underline	2		
E. Hind quarters:			
Hips, wide apart, smooth	3		
Rump, long, wide, evenly fleshed, straight	3		
Hams, heavily fleshed, deep, wide	8		
Thighs, fleshed close to hocks	4		
Tail, tapering	1		
Legs, straight, short, strong; feet medium size	4		
Total	100		

North Carolina College of Agriculture and Mechanic Arts.

Same as the New Hampshire card (see above) for hogs.

North Dakota Agricultural College.

Scale of points. ^a	Perfect score.	Points deficient.	
		Student's score.	Corrected.
General appearance:			
Weight, estimated, — pounds; actual, — pounds; score according to age	6		
Form, deep, broad, low, long, symmetrical, compact; standing squarely on legs	8		
Quality, bone clean; hair silky; skin fine	8		
Disposition, quiet	5		
Head and neck:			
Snout, length medium, not coarse	1		
Eyes, full, mild, bright, large	1		
Face, short; cheeks full	1		
Ears, fine; size medium; soft	1		
Jowl, strong, neat, broad	1		
Neck, thick; length medium	1		
Fore quarters:			
Shoulder vein, full	2		
Shoulder, broad, deep, full, compact on top	8		
Breast, advanced, wide	2		
Legs, straight, short, strong; feet medium size	5		
Body:			
Chest, deep, broad; girth large	8		
Sides, deep, lengthy, closely ribbed	8		
Back, straight, broad, thickly and evenly fleshed	4		
Loin, wide, thick	3		
Belly, straight	2		
Flank, even with under line	2		
Hind quarters:			
Hips, wide apart, smooth	3		
Rump, long, wide, evenly fleshed, straight	3		
Hams, heavily fleshed, deep, wide	8		
Thighs, fleshed close to hocks	4		
Legs, straight, short, strong; feet medium size	5		
Total	100		

^a After Craig.

Oklahoma Agricultural and Mechanical College.

Scale of points.	Possible score.	Name of animals.			
General appearance—40 points:					
Weight: Six months, 200 pounds; 12 months, 350 pounds; 18 months, 450 pounds; 24 months, 500 pounds					
Estimated, pounds					
Actual, pounds					
According to age	8				
Form, deep, broad, low, long, symmetrical, compact; standing squarely on legs	10				
Quality, bone clean; hair silky; skin fine; flesh free from lumps and wrinkles	10				
Condition, deep, even covering of flesh, especially in region of valuable cuts	12				
Head and neck—6 points:					
Snout, length medium; not coarse	1				
Eyes, full, bright, large	1				
Face, short; cheeks, full	1				
Ears, fine, soft; medium size	1				
Jowl, long, neat, broad, full to brisket and shoulder	1				
Neck, thick; length medium	1				
Fore quarters—7 points:					
Shoulder, broad, deep, full, compact on top	5				
Breast, advanced, broad	1				
Legs, straight, short, strong; pasterns upright	1				
Body—28 points:					
Chest, deep, broad; girth large	4				
Sides, deep, lengthy, close ribbed	7				
Back, broad, straight, thickly and evenly fleshed	8				
Loin, broad, thick	5				
Belly, straight, wide	2				
Flank, even with under line	2				
Hind quarters—19 points:					
Hips, smooth, wide apart	2				
Rump, long, wide, evenly fleshed, straight	2				
Hams, heavily fleshed, deep, wide, full	12				
Thighs, fleshed close to hocks	2				
Legs, straight, short, strong, well placed; pasterns upright	1				
Total	100				

The Pennsylvania State College.

Scale of points.	Perfect score.	Points deficient.	
		Student's score.	Corrected.
General appearance:			
Weight, estimated, — pounds; actual, — pounds; score according to age.....	5		
Objections, undersize, overgrown, coarse, slow to fatten.			
Form, deep, broad, low, long, symmetrical, compact, standing squarely on legs.....	7		
Objections, narrow hams; broad, heavy shoulders; loosely jointed, unsymmetrical.			
Quality, bone clean; hair silky; skin fine.....	6		
Objections, bone large, coarse, without taper; pasterns long; hair coarse, harsh, not evenly distributed.			
Disposition, quiet, gentle, easy to handle.....	3		
Objections, cross, restless, wild.			
Head and neck:			
Snout, length medium; not coarse.....	2		
Objections, long, thick, coarse.			
Face, short; cheek, full.....	2		
Objections, long, narrow between eyes.			
Eyes, full, mild, bright.....	1		
Objections, small, dull, deep set; vision impaired by wrinkles.			
Ears, fine; size medium; soft.....	2		
Objections, large, coarse; knuckle long or large; difference in size or position one with another.			
Jowl, strong, neat, broad.....	2		
Objections, light, flabby, rough, deeply wrinkled, not carrying fullness back to the shoulder or brisket.			
Neck, thick; length medium.....	2		
Objections, long, flat, lacking in fullness and depth.			
Fore quarters:			
Shoulder, broad, deep, full, compact on top.....	8		
Objections, lacking in depth or width; thick beyond the line of sides and hams; extending above line of back; shield too coarse and prominent.			
Breast, advanced, wide.....	2		
Objections, narrow, contracted.			
Legs, short, strong; feet medium size; hoof erect, capable of bearing good weight.....	5		
Objections, legs long, slim, coarse, crooked; hoof long, slim, weak, unable to bear weight of animal without breaking down.			
Body:			
Chest, broad, deep; girth large.....	10		
Objections, flat, pinched; breastbone crooked.			
Sides, deep, lengthy, closely ribbed.....	7		
Objections, flat, thin, not full at bottom as on top, drawn in at shoulders, tucked up as it approaches hams; lumpy or uneven surface.			
Back, broad, straight, thickly and evenly fleshed.....	8		
Objections, narrow, creased back of shoulders, hollow or humped, too long or tapering at the hams.			
Loin, wide, thick.....	5		
Objections, high, narrow, depressed, humped up.			
Belly, straight, wide, full.....	3		
Objections, narrow, sagging, flabby.			
Flank, even with under line, full.....	3		
Objections, thin, tucked up, drawn in.			
Hind quarters:			
Hips, wide apart, smooth.....	2		
Objections, narrow, peaked.			
Rump, long, wide, evenly fleshed, straight.....	2		
Objections, flat, narrow, peaked at root of tail, too steep.			
Hams, heavily fleshed, deep, wide.....	8		
Objections, narrow, short, thin; not projecting beyond and coming down to hock; cut up too high in the twist; straight from root of tail to hock; buttocks light, thin, flabby.			
Legs, straight, short, strong; feet medium size.....	5		
Objections, legs long, thin, coarse, crooked; hoofs long, slim, weak, unable to bear weight of animal without breaking down.			
Total	100		

State Agricultural and Mechanical College of the University of Tennessee.

Scale of points.	Perfect score.	Student's score.
A. General appearance:		
1. Estimated weight, — pounds; actual, — pounds.....	6	
2. Weight, according to age, 6-8 months, 200-250 pounds.....	6	
3. Form, deep, broad, low, symmetrical, compact, standing squarely on legs.....	6	
4. Quality, bone clean; hair silky; skin fine.....	4	
5. Disposition, quiet.....	4	
6. Constitution, vigorous, robust, showing size and substance.....	5	
B. Head and neck:		
7. Snout, of medium length and fineness.....	1	
8. Eyes, full, mild, bright, large.....	1	
9. Face, short; cheeks full.....	1	
10. Forehead, broad, high, full.....	1	
11. Ears, of medium size, fine, soft.....	1	
12. Jaw, strong, neat, broad.....	1	
13. Neck, of medium length, thick.....	1	
C. Fore quarters:		
14. Shoulder vein, full.....	1	
15. Shoulder, broad, deep, full; top compact.....	7	
16. Breast, full, wide.....	2	
17. Legs, straight, short, strong; feet of medium size.....	3	
D. Body:		
18. Chest, deep, broad; girth large.....	10	
19. Sides, deep, lengthy, closely ribbed.....	8	
20. Back, broad, straight, thickly and evenly fleshed.....	4	
21. Loin, wide, thick.....	3	
22. Belly, straight.....	2	
23. Flank, even with underline.....	1	
24. Navel, large, defined.....	1	
E. Hind quarters:		
25. Hips, wide apart, smooth.....	3	
26. Rump, long, wide, straight, evenly fleshed.....	3	
27. Hams, deep, wide, heavily fleshed.....	8	
28. Thighs, fleshed close to hocks.....	4	
29. Twist, deep, plump.....	1	
30. Tail, tapering.....	1	
31. Legs, straight, short, strong; feet of medium size.....	4	
Total.....	100	

State Agricultural and Mechanical College of the University of Tennessee.

Scale of points.	Perfect score.	Student's score.
A. Primary considerations:		
1. Weight, — pounds	3	
2. Size and substance, for age	4	
3. Action, vigorous, easy	4	
4. Appearance, cylindrical, smooth, compact	4	
5. Quality, skin, smooth, pliable; flesh firm; hair soft, fine, silky	5	
B. Nervous energy:		
6. Temperament, active, controlled	7	
7. Eyes, large, clear, bright, mild, placid, free from white	6	
8. Forehead, broad, high; face short	4	
9. Ears, broad, medium, thin, active	2	
10. Spinal column, long, well covered	7	
C. Structural anatomy:		
11. Contour, clean-cut, smooth, correlated, symmetrical, free from patchiness and offal	1	
12. Head, size medium; snout medium; face short	1	
13. Neck, thick, short	1	
14. Withers, broad on top, well fleshed; shoulder well covered, slanting	1	
15. Shoulder, heavy, broad, deep, full	1	
16. Back, broad, strong, well muscled	2	
17. Loin, broad, strong	3	
18. Pelvic arch, suppressed, well covered	2	
19. Flank, lean; twist full; thigh full, recurved	1	
20. Bones, medium; feet strong	2	
D. Digestion and assimilation:		
21. Nostrils, medium-sized, clear, bright	1	
22. Breast, full, low	2	
23. Chest, wide, deep, long; girth large	7	
24. Middle piece, long, broad on top, deep	9	
25. Ribs, flat, well arched, deeply covered	3	
26. False ribs, well developed	3	
E. Essential qualities:		
27. Top line, straight or slightly arched; bottomline straight, close to ground	1	
28. Size and weight, indicating tendency to mature early	4	
29. Middle piece, well developed, giving strong back and deep long side	7	
30. Long from hook points to pin bones, and to hock; hams uniform, massive, meaty	4	
31. Constitution, vigorous; bones sufficient for weight	2	
Total.....	100	

Agricultural and Mechanical College of Texas.

Scale of points.	Possible score.	Student's score.	Corrected.
A. General appearance:			
Estimated weight, — pounds	6		
Weight, according to age	8		
Form, deep, broad, low, symmetrical, compact, standing squarely on legs	8		
Quality, bone, clean; hair silky; skin fine	8		
Disposition, quiet	5		
B. Head and neck:			
Snout, of medium length and fineness	1		
Eyes, full, mild, bright, large	1		
Face, short; cheeks full	1		
Ears, fine, soft; size medium	1		
Jowl, strong, neat, broad	1		
Neck, thick; length medium	1		
C. Fore quarters:			
Shoulder vein, full	1		
Shoulder, broad, deep, full; top compact	8		
Breast, full, wide	4		
Legs, straight, short, strong; feet of medium size	2		
D. Body:			
Chest, deep, broad; girth large	10		
Sides, deep, lengthy, closely ribbed	8		
Back, broad, straight, thickly and evenly fleshed	4		
Loin, wide, thick	3		
Belly, straight	2		
Flank, even with under line	2		
E. Hind quarters:			
Hips, wide apart, smooth	3		
Rump, long, wide, straight, evenly fleshed	3		
Hams, deep, wide, heavily fleshed	8		
Thighs, fleshed close to hocks	4		
Tail, tapering	1		
Legs, straight, short, strong; feet of medium size	4		
Total	100		

Agricultural College of Utah.

Scale of points.	Score.		
	Stand- ard.	Student's.	Corrected.
General appearance:			
Age, estimated, —; actual, —			
Weight, estimated, — pounds; actual, — pounds; score according to age	6		
Form, deep, broad, low, long, symmetrical, compact, standing squarely on legs	8		
Quality, bone clean; hair silky; skin fine	8		
Disposition, quiet	5		
Head and neck:			
Snout, length medium; not coarse	1		
Eyes, full, mild, bright, large	1		
Face, short; cheeks full	1		
Ears, soft, fine; size medium	1		
Jowl, strong, neat, broad	1		
Neck, thick; length medium	1		
Fore quarters:			
Shoulder vein, full	2		
Shoulder, broad, deep, full, compact on top	8		
Breast, advanced, wide	2		
Legs, straight, short, strong; feet medium size	5		
Body:			
Chest, deep, broad; girth large	8		
Sides, deep, lengthy, closely ribbed	8		
Back, broad, straight, thickly and evenly fleshed	4		
Loin, wide, thick	3		
Belly, straight	2		
Flank, even with under line	2		
Hind quarters:			
Hips, wide apart, smooth	3		
Rump, long, wide, evenly fleshed, straight	3		
Hams, heavily fleshed, deep, wide	8		
Thighs, fleshed close to hocks	4		
Legs, straight, short, strong; feet medium size	5		
Total	100		

College of Agriculture of the University of Wisconsin.

Scale of points.	Possible score.	Points deficient.	
		Student's score.	Corrected.
General appearance—25 points:			
Weight, estimated, — pounds; actual, — pounds; according to age	6		
Form, deep, broad, low, long, symmetrical, compact, standing squarely on legs	8		
Quality, bone clean; hair silky; skin fine	6		
Disposition, quiet	5		
Head and neck—10 points:			
Snout, not coarse; length medium	1		
Eyes, large, mild, full, bright, wide apart	1		
Forehead, broad	1		
Face, short; cheeks full	1		
Ears, fine, soft; size medium	1		
Jowl, strong, neat, broad	2		
Neck, thick; length medium	3		
Fore quarters—13 points:			
Shoulder, broad, deep, full, compact on top	6		
Breast, wide, prominent	2		
Legs, straight, short, strong; feet medium size	5		
Body—32 points:			
Chest, deep, broad; girth large	7		
Sides, deep, lengthy, closely ribbed	8		
Back, broad, straight, thickly and evenly fleshed	7		
Loin, thick, wide	5		
Belly, straight	3		
Flank, even with under line	2		
Hind quarters—20 points:			
Hips, wide apart, smooth	3		
Rump, long, wide, evenly fleshed, straight	4		
Hams, heavily fleshed, deep, wide	8		
Legs, straight, short, strong; feet medium size	5		
Total	100		

LARD HOGS.

College of Agriculture of the University of Illinois.

Scale of points.	Perfect score.	Student's score.	Corrected.
General appearance—30 points:			
1. Weight, score according to age.....	6		
2. Form, deep, broad, low, long, symmetrical, compact; standing squarely on legs.....	8		
3. Quality, hair silky; skin fine; bone fine; mellow covering of flesh, free from lumps and wrinkles.....	8		
4. Condition, deep, even covering of flesh, especially in region of valuable cuts.....	8		
Head and neck—9 points:			
5. Snout, length medium; not coarse.....	1		
6. Eyes, full, mild, bright.....	1		
7. Face, short; cheeks full.....	1		
8. Ears, fine; size medium; attached neatly.....	1		
9. Jaw, strong, neat, broad, firm.....	2		
10. Neck, thick, smooth to shoulder; length medium.....	2		
Fore quarters—12 points:			
11. Shoulder, broad, deep, full; compact on top.....	8		
12. Breast, advanced, wide.....	2		
13. Legs, straight, short, strong; bones clean; pasterns upright; feet medium size.....	2		
Body—32 points:			
14. Chest, deep, broad; girth large.....	2		
15. Sides, deep, lengthy, full; ribs close, well sprung.....	8		
16. Back, broad, straight, thickly and evenly fleshed.....	10		
17. Loin, wide, thick, straight.....	10		
18. Belly, straight, even.....	2		
Hind quarters—18 points:			
19. Hips, wide apart, smooth.....	3		
20. Rump, long, wide, evenly fleshed, straight.....	3		
21. Ham, heavily fleshed, plump, full, deep, wide.....	10		
22. Legs, straight, short, strong; bone clean; pasterns upright; feet medium size.....	2		
Total.....	100		

School of Agriculture of Purdue University.

Scale of points.	Standard.	Student's score.	Corrected.
General appearance—30 points:			
1. Weight, score according to age.....	4		
2. Form, deep, broad, low, long, symmetrical, compact; standing squarely on legs.....	8		
3. Quality, hair silky; skin fine; bone fine; covering of flesh mellow, free from lumps and wrinkles.....	8		
4. Condition, deep, even covering of flesh, especially in region of valuable cuts.....	8		
5. Temperament, mild, quiet.....	2		
Head and neck—8 points:			
6. Snout, length medium; not coarse.....	1		
7. Eyes, full, mild, bright.....	1		
8. Face, short; cheeks full.....	1		
9. Ears, fine; size medium; attached neatly.....	1		
10. Jaw, strong, neat, broad, firm.....	2		
11. Neck, thick, smooth to shoulder; length medium.....	2		
Fore quarters—12 points:			
12. Shoulder, broad, deep, full, compact on top.....	8		
13. Breast, advanced, wide.....	2		
14. Legs, straight, short, strong; bones clean; pasterns upright; feet medium size.....	2		
Body—32 points:			
15. Chest, deep, broad; girth large.....	4		
16. Sides, deep, lengthy, full; ribs close, well sprung.....	8		
17. Back, broad, straight, thickly and evenly fleshed.....	9		
18. Loin, wide, thick, straight.....	9		
19. Belly, straight, even.....	2		
Hind quarters—18 points:			
20. Hips, wide apart, smooth.....	3		
21. Rump, long, level, wide, evenly fleshed, straight.....	3		
22. Ham, heavily fleshed, plump, full, deep, wide.....	10		
23. Legs, straight, short, strong; bone clean; pasterns upright; feet medium size.....	2		
Total.....	100		

Iowa State College of Agriculture and the Mechanic Arts.

Scale of points.	Perfect score.
General appearance:	
1. Weight, score according to age.....	6
2. Form, deep, broad, low, long, symmetrical, compact; standing squarely on legs.....	10
3. Quality, hair silky; skin fine; bone fine; covering of flesh mellow, free from lumps and wrinkles.....	10
4. Condition, deep, even covering of flesh, especially in regions of valuable cuts.....	10
Head and neck:	
5. Snout, medium length; not coarse.....	1
6. Eyes, full, mild, bright.....	1
7. Face, short; cheeks full.....	1
8. Ears, fine; medium size; soft.....	1
9. Jaw, strong, neat, broad.....	1
10. Neck, thick; length medium.....	1
Fore quarters:	
11. Shoulder, broad, deep, full, compact on top.....	6
12. Breast, advanced, wide.....	2
13. Legs, straight, short, strong; bone clean; pasterns upright; feet medium size.....	2
Body:	
14. Chest, deep, broad; girth large.....	2
15. Sides, deep, lengthy, full; ribs close, well sprung.....	6
16. Back, broad, straight, thickly and evenly fleshed.....	10
17. Loin, wide, thick, straight.....	10
18. Belly, straight, even.....	2
Hind quarters:	
19. Hips, wide apart, smooth.....	2
20. Rump, long, wide, evenly fleshed, straight.....	2
21. Ham, heavily fleshed, plump, full, deep, wide.....	10
22. Thighs, fleshed close to hocks.....	2
23. Legs, straight, short, strong; bone clean; pasterns upright; feet medium size.....	2
Total	100

Agricultural and Mechanical College of Kentucky.

Same as Iowa card (see above), with the following exception: Under quality, read "flesh smooth, mellow, free from lumps and wrinkles," etc.

College of Agriculture of the University of Minnesota.

Same as the Iowa card (see above) for lard hogs, with two exceptions: Under quality, read "skin mellow," etc.; under sides, read "medium length," etc.

The College of Agriculture and Domestic Science, Ohio State University.

Scale of points.	Score.		
	Perfect score.	Student's score.	Corrected.
A. General appearance—28 points:			
Weight, estimated, —; actual, — pounds; according to age.	4		
Form, deep, broad, low, symmetrical, compact; standing squarely on legs.	7		
Quality, bone clean; hair silky; skin fine.	10		
Disposition, quiet.	3		
Action and style, vigorous, easy.	4		
B. Head and neck—8 points:			
Snout, medium, too short, not coarse; length, — inches.	1		
Eyes, full, mild, bright, large.	1		
Face, short; cheeks full, without wrinkles.	1		
Ears, fine; size medium; soft, neatly attached.	1		
Jowl, strong, neat, broad, full to shoulders.	2		
Neck, thick, short, broad on top.	2		
C. Fore quarters—14 points:			
Shoulder vein, full.	1		
Shoulder, broad, deep, full, compact on top.	5		
Breast, advanced, wide, roomy.	3		
Legs, straight, short, strong, wide apart, well set.	2		
Pasterns, strong, straight, upright.	3		
D. Body—29 points:			
Chest, deep, broad; girth large, — inches.	8		
Sides, full and smooth from hams to shoulder, close ribbed.	8		
Back, broad, straight, thickly and evenly fleshed.	6		
Loin, wide, thick.	3		
Belly, straight, wide.	2		
Flank, even with under line; girth of body, — inches.	2		
E. Hind quarters—21 points:			
Hips, smooth.	2		
Rump, long, wide, level, well filled out.	3		
Hams, heavily fleshed, deep, wide, thick.	10		
Legs, straight, short, strong, wide apart, well set.	2		
Pasterns, strong, straight, upright.	3		
Tail, tapering.	1		
Total.	100		

South Dakota Agricultural College.

Same as the Iowa card (see p. 93) for lard hogs.

BACON HOGS.

College of Agriculture of the University of Illinois.

Same as the Iowa card (see p. 95) for bacon hogs.

School of Agriculture of Purdue University.

Same as the Iowa card (see p. 95) for bacon hogs.

Iowa State College of Agriculture and the Mechanic Arts.

Scale of points.		Perfect score.
General appearance:		
1. Weight, 170 to 200 pounds, the result of thick cover of firm flesh.....		6
2. Form, long, level, smooth, deep.....		10
3. Quality, hair fine; skin thin; bone fine; firm, covering of flesh without any soft bunches of fat or wrinkles.....		10
4. Condition, deep, uniform covering of flesh, especially in region of valuable cuts.....		10
Head and neck:		
5. Snout, fine.....		1
6. Eyes, full, mild, bright.....		1
7. Face, slim.....		1
8. Ears, trim; size medium.....		1
9. Jowl, light, trim.....		1
10. Neck, light; length medium.....		1
Fore quarters:		
11. Shoulders, free from roughness, smooth, compact, same width as back and hind quarters.....		6
12. Breast, moderately wide, full.....		2
13. Legs, straight, short, strong; bone clean; pasterns upright; feet medium size.....		2
Body:		
14. Chest, deep; girth full.....		4
15. Back, smooth; width medium, uniform.....		8
16. Sides, long, smooth, level from beginning of shoulders to end of hind quarters; the side at all points should touch a straightedge running from fore to hind quarter.....		10
17. Ribs, deep, uniformly sprung.....		2
18. Belly, trim, firm, thick without any flabbiness or shrinkage at flank.....		10
Hind quarters:		
19. Hips, smooth, wide, proportionate to rest of body.....		2
20. Rump, long, even, straight, rounded toward tail.....		2
21. Gammon, firm, rounded, tapering, fleshed deep and low toward hocks.....		8
32. Legs, straight, short, strong; feet medium size; bone clean; pasterns upright.....		2
Total		100

Michigan State Agricultural College.

Scale of points.	Perfect.	Student's estimate.	Corrected.
Head and neck:			
Snout, moderately fine.....	1		
Eyes, size good; full, bright.....	1		
Jowl, light, neat.....	3		
Neck, rather light, with no tendency to arch on top; length medium.....	3		
Fore quarters:			
Shoulders, light, smooth, rounded from side to side over top, very compact, no wider than back.....	9		
Breast, full; width good.....	4		
Fore legs, set well apart, straight; length medium; pasterns upright; bone flat, clean, moderately fine.....	4		
Body:			
Back, rising slightly above the straight line, and forming a very slight arch from neck to tail; width medium.....	9		
Loin, strong, full, but not unduly arched, wide as rest of back.....	5		
Ribs moderately arched; length good.....	3		
Side, fairly deep, long, smooth, straight between shoulder and ham; a straightedge laid over shoulder point and ham should touch the side throughout.....	12		
Heart girth, full, but not flabby at foreflanks, filled out even with side of shoulder; there should be no tucked up appearance back of forelegs, nor droop back of shoulder top.....	5		
Flank, full, low.....	1		
Underline, straight; the belly should be markedly trim and neat.....	5		
Hind quarters:			
Rump, same width as back, long, slightly rounded from a point above hips to tail, and rounded from side to side over top.....	5		
Ham, full without flabbiness; thigh tapering toward hock without wrinkles or folds, carrying flesh well down toward hock.....	6		
Hind legs, length medium; hocks set well apart but not bowed outward; bone flat, clean, moderately fine; pasterns strong.....	4		
Quality:^a			
Ear, rather thin (1); hair fine, abundant (2); skin smooth, showing no tendency to wrinkle (2); bone flat, clean in legs, moderately fine in snout and head, showing no prominence on side and top of shoulder (5); flesh firm, smooth, with no flabbiness at jowl, foreflank, belly or ham (5).....	15		
Style:			
Active, sprightly in movement, walking without a swaying motion, standing well up on toes.....	5		
N. B. —For hogs intended for killing, the same scale of points may be used with the following modifications: Strike out score for eyes, ears, hair, and style, deduct two points from points allowed forelegs and also hindlegs, and add following score:			
Weight, 175 to 200 pounds, live weight; being under 160 pounds or over 220 pounds will disqualify.....	13		
Total			

^a Numbers in parentheses indicate perfect score of points enumerated.—G. M. R.

SHEEP.

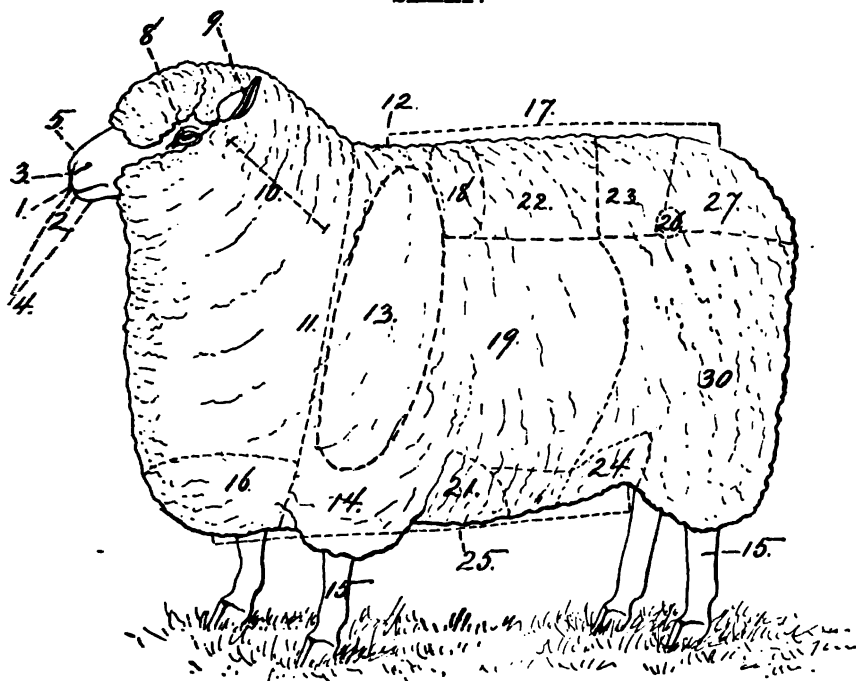


FIG. 8.—Points of the sheep, side view.

- | | | | |
|-------------|----------------------------------|-------------------------|------------------------------|
| 1. Muzzle. | 10. Neck. | 16. Brisket, or breast. | 24. Hind flank. |
| 2. Mouth. | 11. Neck vein, or shoulder vein. | 17. Top line. | 25. Underline. |
| 3. Nostril. | 12. Top of shoulder. | 18. Crops. | 26. Hip. |
| 4. Lips. | 13. Shoulder. | 19. Ribs. | 27. Rump. |
| 5. Nose. | 14. Arm. | 20. Fore flank. | 28. Thigh, or leg of mutton. |
| 6. Eye. | 15. Shanks. | 21. Arm. | |
| 7. Ear. | | 22. Back. | |
| | | 23. Loin. | |

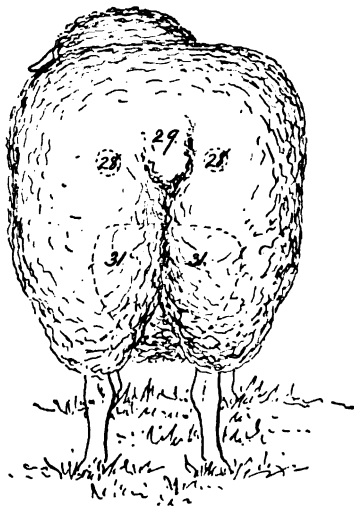
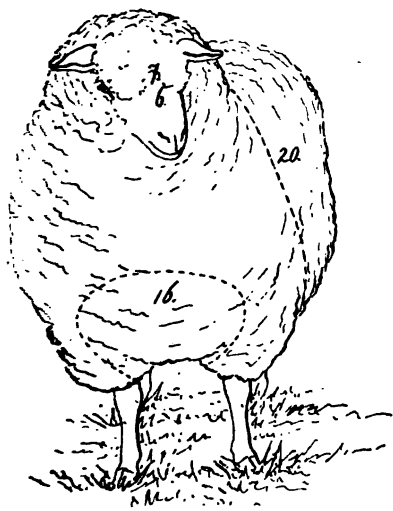


FIG. 9.—Points of the sheep, front and rear views.

- | | | | |
|--------------|----------------------------|--------------------|------------|
| 6. Face. | 16. Brisket, or breast. | 28. Pin bones. | 31. Twist. |
| 7. Forehead. | 20. Girth, or heart girth. | 29. Dock, or tail. | |

New Hampshire College of Agriculture and the Mechanic Arts.

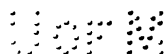
Scale of points.	Mutton sheep.			Wool sheep.		
	Standard.	Students.	Corrected.	Standard.	Students.	Corrected.
A. General appearance:						
Weight, estimated, — pounds; actual, — pounds; standard for mature ram, —; ewe, —	6			4		
Form, for M., low, compact, symmetrical; for W., rather the reverse	6			5		
Quality, should not be coarse in bone, fleece, or features; firm in handling, yet with soft, pliable skin of bright pink color	7			6		
Constitution, shown by fleece, skin, girth, and movement	10			10		
B. Head and neck:						
Muzzle, mouth and nostrils of good size; lips thin	1			1		
Eyes, bright, prominent; whites clear	2			2		
Face, short, except in Oxfords, Hampshires, and Cotswolds	1			1		
Forehead, broad, full	2			2		
Ears, well apart, covered with fine soft hair; in size and form typical of breed	1			1		
Neck, for M., short, thick, neatly tapering to head; for W., longer, drooping at yoke	2			1		
C. Fore quarters:						
Shoulders, for M., smoothly joined with neck and body, broad on top, compact; for W., less closely joined	6			4		
Breast, broad, carried well forward, closely joined to legs	4			3		
Legs, short, straight, strong, well apart: arm full	2			2		
D. Body:						
Back and loin, straight, broad	8			5		
Ribs, springing from spine in such a plane as to make back broad and flat; for wool, slope downward from spine	4			2		
Chest, showing no depression above, at sides, or below, making large girth	6			4		
Flank, low, full	3			2		
E. Hind quarters:						
Hips, broad, flat above	4			2		
Rump, long, level, wide	4			2		
Thighs, full, less so for W.	5			2		
Twist, deep, plump	4			2		
Legs, straight, short, strong, but not coarse	2			2		
F. Wool:						
Quality, fine for breed, soft, even	3			12		
Density, great, even	3			10		
Length, great, even	3			10		
Yolk, slight amount	1			8		
Total	100			100		

North Carolina College of Agriculture and Mechanic Arts.

Same as the card (see above) of the New Hampshire College for sheep

School of Agriculture of Purdue University.

Scale of points.	Mutton sheep.			Fine-wool sheep.		
	Score.			Score.		
	Stand- ard.	Stu- dent's.	Cor- rected.	Stand- ard.	Stu- dent's.	Cor- rected.
A. Age, —; teeth —						
B. General appearance:						
Weight, estimated, — pounds; actual, — pounds, according to age	6			4		
Form, low, compact, symmetrical	6			5		
Quality, bone and wool fine	7			9		
Constitution, as seen in girth, skin, and fleece	10			10		
C. Head and neck:						
Muzzle, fine; mouth and nostrils of good size; lips thin	1			1		
Eyes, bright, full; whites clear	1			1		
Face, short	1			1		
Forehead, broad	1			1		
Ears, fine, erect	1			1		
Neck, thick, short	1			1		
D. Fore quarters:						
Shoulders, smooth, well covered	6			4		
Chest, wide, deep	6			5		
Brisket, thick, carried well forward	4			3		
Legs, straight, short, strong, well set; arm full; shank smooth	3			3		
E. Body:						
Back and loin, straight, wide	8			6		
Ribs, well sprung, deep	4			3		
Flanks, low, making straight underline	3			2		
F. Hind quarters:						
Hips, well apart, smooth	4			2		
Rump, long, level, wide	5			3		
Thighs, full	5			3		
Twist, plump, deep	4			3		
Legs, straight, short, strong; shank smooth	3			3		
G. Wool:						
Quality, fine, soft, clean, even	3			11		
Density, great	3			6		
Length, good	3			5		
Yolk	1			4		
Total	100			100		



State Agricultural and Mechanical College of the University of Tennessee.

Scale of points.		Perfect score.	Student's score.
A. General appearance:			
1. Weight, estimated, — pounds; actual, — pounds		8	
2. Weight, according to age; 6 months, 60-90 pounds; yearlings, 100-140 pounds		8	
3. Form, deep, broad, low set; carriage good		8	
4. Quality, hair silky; skin pink; bone dense; style active, sprightly		5	
5. Constitution, heart girth large; brisket well forward, showing size and substance		8	
6. Temperament, contented, docile		3	
B. Head and neck:			
7. Muzzle, fine; mouth and nostrils large, no flabbiness about mouth		1	
8. Eyes, large, clear, placid		1	
9. Face, short; features clean cut		1	
10. Forehead, broad, full		1	
11. Ears, fine, erect		1	
12. Neck, medium, short, well fleshed; throat clean		1	
C. Fore quarters:			
13. Shoulder vein, full		1	
14. Shoulder, wide across top, compact, well fleshed, smooth		3	
15. Brisket, well forward; breast wide		2	
16. Legs, straight, short, wide apart; forearm full		2	
D. Body:			
17. Chest, wide, deep		3	
18. Ribs, long, well arched, well covered		3	
19. Back, broad, straight, well fleshed; ribs arched		7	
20. Loin, broad, strong		9	
21. Flank, low, even with underline		2	
E. Hind quarters:			
22. Hips, wide, smooth		3	
23. Rump, long, level, wide		3	
24. Pin bones, smooth, wide		2	
25. Thighs, full, long, wide		5	
26. Twist, low, well filled		5	
27. Legs, straight, short		2	
F. Wool:			
28. Fleece, dense, covering all parts of body evenly; yolk plentiful, free from kemp		6	
29. Fiber, bright, lustrous, strong, even; spirals regular		4	
Total		100	

State Agricultural and Mechanical College of the University of Tennessee.

Scale of points.		Perfect score.	Student's score.
A. Primary considerations:			
1. Weight, — pounds	.....	3	.....
2. Size and substance, for age	.....	4	.....
3. Style, attractive, sprightly; breeding apparent	.....	4	.....
4. Appearance, square, blocky	.....	4	.....
5. Quality, skin pink; flesh firm; hair soft, fine, silky	.....	5	.....
B. Nervous energy:			
6. Temperament, active, controlled	.....	7	.....
7. Eyes, large, clear, bright, mild, placid, free from white	.....	6	.....
8. Forehead, broad, high	.....	3	.....
9. Ears, small, thin, active	.....	2	.....
10. Spinal column, medium, well covered	.....	6	.....
11. Navel, large, defined	.....	2	.....
C. Structural anatomy:			
12. Contour, clean cut, smooth, correlated, symmetrical, free from patchiness and offal	.....	2	.....
13. Head, medium in size; muzzle refined; mouth large; face lean	.....	1	.....
14. Neck, fine; length medium; throat clean	.....	1	.....
15. Withers, broad on top, well covered, compact; shoulder well covered, slanting	.....	1	.....
16. Back, straight, strong, well muscled	.....	2	.....
17. Loin, broad, strong	.....	3	.....
18. Pelvic arch, suppressed, smooth; pin bones wide	.....	2	.....
19. Flank, low; twist full; thigh full	.....	1	.....
20. Bones, fine, joints smooth	.....	2	.....
D. Digest and assimilation:			
21. Nostrils, medium-sized, clear, bright	.....	1	.....
22. Breast and brisket, prominent, low	.....	1	.....
23. Chest, wide, deep, long; girth large	.....	8	.....
24. Barrel, medium long, broad on top, deep, capacious	.....	9	.....
25. Ribs, flat, close together, well arched	.....	3	.....
26. False ribs, well developed	.....	3	.....
E. Mutton and wool:			
27. Form, deep, broad, long, low set, evenly covered with firm flesh	.....	6	.....
28. Back, broad, level, flesh firm, well covered	.....	4	.....
29. Hind quarters, meaty, well developed	.....	4	.....
30. Fleece, covering body evenly, dense; wool strong, even, bright	.....	3	.....
31. Yolk, abundant; fleece free from kemp	.....	1	.....
Total	.....	100	.....

Agricultural College of Utah.

Scale of points.	Score.					
	Mutton.			Fine wool.		
	Standard.	Student's.	Corrected.	Standard.	Student's.	Corrected.
General appearance:						
Age, as indicated by teeth —; corrected —						
Weight, estimated, —; actual, —; score according to age.	6			5		
Form, low, long, symmetrical, compact	5			4		
Quality, bone clean, strong; hair silky	5			4		
Temperament, quiet						
Head and neck:						
Muzzle, fine; mouth large; lips thin; nostrils large	1			1		
Eyes, bright, full; whites clear	2			2		
Face, short; expression quiet	1			1		
Forehead, broad	1			1		
Ears, firm, erect, lively	1			1		
Neck, thick, short, heavier toward shoulders	2			1		
Fore quarters:						
Shoulder vein, full	2			1		
Shoulders, compact, covered with flesh	3			3		
Chest, wide, deep	3			3		
Brisket, projecting forward; breast wide	2			2		
Legs, straight, short, wide apart, strong; forearm full; shanks fine	2			2		
Body:						
Back, straight, wide, well covered	4			3		
Loin, thick, broad	3			3		
Ribs, arched, deep	3			2		
Flank, low, thick, making under line straight	2			2		
Hind quarters:						
Hips, far apart, smooth	3			2		
Rump, long, level, wide	4			2		
Thighs, full, well fleshed	4			2		
Twist, plump, deep	4			3		
Legs, straight, short, strong; shanks smooth	3			3		
Constitution:						
Girth, large; — feet, — inches	3			3		
Skin, soft; color, pink	3			4		
Fleece, dense, even over the body	2			5		
Yolk, abundant, evenly distributed	2			4		
Wool:						
Quantity, long, dense, even	6			7		
Quality, fine, soft, pure, even; fibre lustrous	4			11		
Condition, bright, strong, clean	4			5		
Total	100			100		

Wool

MUTTON SHEEP.

College of Agriculture of the University of Illinois.

Same as the Indiana card (see below) for mutton sheep. The Illinois card uses the word "condition" in the description of the chest instead of "constitution," which is probably a typographical error.

School of Agriculture of Purdue University.

Scale of points.	Stand- ard.	Student's score.	Corrected.
1. Age, —			
General appearance—38 points:			
2. Weight, score according to age	8		
3. Form, long, level, deep, broad, low set, stylish	10		
4. Quality, bone clean; hair silky; skin fine; light in offal, yielding large percentage of meat	10		
5. Condition, deep, even covering of firm flesh, especially in region of valuable cuts; points indicating condition or ripeness are thick dock, back thickly covered with flesh, thick neck, full purse, full flank, plump breast	10		
Head and neck—7 points:			
6. Muzzle, fine; mouth large; lips thin; nostrils large	1		
7. Eyes, large, clear, placid	1		
8. Face, short; features clean cut	1		
9. Forehead, broad, full	1		
10. Ears, fine, erect	1		
11. Neck, thick, short; throat free from folds	2		
Fore quarters—7 points:			
12. Shoulder, covered with flesh, compact on top, smooth	5		
13. Brisket, projecting forward; breast wide	1		
14. Legs, straight, short, wide apart, strong; forearm full; shank smooth, fine	1		
Body—20 points:			
15. Chest, wide, deep, full, indicating constitution	4		
16. Ribs, well sprung, deep	4		
17. Back, broad, straight, long, thickly fleshed	6		
18. Loin, thick, broad, long	6		
Hind quarters—16 points:			
19. Hips, far apart, level, smooth	2		
20. Rump, long, level, wide to tailhead	4		
21. Thighs, full, deep, wide	4		
22. Twist, plump, deep	5		
23. Legs, straight, short, strong; shank smooth, fine	1		
Wool—12 points:			
24. Quantity, long, dense, even	4		
25. Quality, fine, pure; crimp close, regular, even	4		
26. Condition, bright, sound, clean, soft, light	4		
Total	100		

Iowa State College of Agriculture and the Mechanic Arts.

	Scale of points.	Perfect score.
1. Age —		
General appearance:		
2. Weight, score according to age		8
3. Form, long, level, deep, broad, low set, stylish		10
4. Quality, bone clean; hair silky; skin fine; light in offal, yielding large percentage of meat		10
5. Condition, deep, even covering of firm flesh, especially in region of valuable cuts; points indicating condition or ripeness are thick dock, back thickly covered with flesh, thick neck, full purse, full flank, plump breast		10
Head and neck:		
6. Muzzle, fine; mouth large; lips thin; nostrils large		1
7. Eyes, large, clear, placid		1
8. Face, short; features clean cut		1
9. Forehead, broad, full		1
10. Ears, fine, erect		1
11. Neck, thick, short; throat free from folds		1
Fore quarters:		
12. Shoulder vein, full		1
13. Shoulder, covered with flesh, compact on top, smooth		1
14. Brisket, projecting forward; breast wide		1
15. Legs, straight, short, wide apart, strong; forearm full; shank smooth, fine		1
Body:		
16. Chest, wide, deep, full, indicating condition		8
17. Back, broad, straight, long, thickly fleshed; ribs arched		10
18. Loin, thick, broad, long		10
Hind quarters:		
19. Hips, far apart, level, smooth		2
20. Rump, long, level, wide to tailhead		3
21. Thighs, full, deep, wide		3
22. Twist, plump, deep		3
23. Legs, straight, short, strong; shank smooth, fine		1
Wool:		
24. Kind, domestic, territory, carpet or blanket		
25. Class, clothing, delaine or combing		
26. Grade, fine, medium or coarse		
27. Quantity, long, dense, even		4
28. Quality, fine, pure; crimp close, regular, even		4
29. Condition, bright, sound, clean, soft, light		4
Total		100

Agricultural and Mechanical College of Kentucky.

Same as the Iowa card (see above), except that under chest the word "constitution" is used instead of "condition;" this is probably what is intended in the Iowa card.

Massachusetts Agricultural College.

Scale of points.	Possible score.	Points deficient.	
		Student's score.	Corrected.
A. Age, —; teeth, —			
B. General appearance:			
Weight, estimated, — pounds; actual, — pounds; according to age	10		
Form, low, long, symmetrical, compact, evenly covered with firm flesh	10		
Quality, bone clean; hair silky	6		
Temperament	2		
	28		
C. Head and neck:			
Muzzle, fine; mouth large; lips thin; nostrils large	1		
Eyes, bright, full	1		
Face, short; expression quiet	1		
Forehead, broad	1		
Ears, fine, erect	1		
Neck, thick, short	1		
	6		
D. Fore quarters:			
Shoulder vein, full	2		
Shoulders, covered, compact	3		
Chest, wide, deep	3		
Brisket, projecting forward; breast wide	2		
Legs, straight, short, wide apart, strong; forearm full; shank smooth	3		
	13		
E. Body:			
Back, straight, wide	4		
Loin, thick, broad	3		
Ribs, arched, deep	3		
Flank, low, thick, making underline straight	2		
	12		
F. Hind quarters:			
Hips, far apart, smooth	3		
Rump, long, level, wide	4		
Thighs, full	3		
Twist, plump, deep	4		
Legs, straight, short, strong; shank smooth	3		
	17		
G. Constitution:			
Girth, large	3		
Skin, color pink	3		
Fleece, dense, even over body; yoke abundant	4		
	10		
H. Wool:			
Quantity, long, dense, even	6		
Quality, fine, soft, pure, even	4		
Condition, bright, strong, clean	4		
	14		
Total	100		

Michigan State Agricultural College.

Scale of points.	Stand- ard.	Student's estimate.	Corrected.
A. General appearance:			
Weight, estimated, — pounds; actual, — pounds; standard for mature ram, —; ewe, —	6		
Form, low, compact, symmetrical	6		
Quality, should not be coarse in bone, fleece, or features; firm in handling, yet with soft, pliable skin of bright pink color.	7		
Constitution, shown by fleece, skin, girth, and movement.	10		
B. Head and neck:			
Muzzle, mouth and nostrils of good size; lips thin.	1		
Eyes, bright, prominent; whites clear	2		
Face, short, except in Oxfords, Hampshires, and Cotswolds.	1		
Forehead, broad, full.	2		
Ears, well apart; covered with fine, soft hair; in size and form typical of breed	1		
Neck, short, thick, neatly tapering to head	2		
C. Fore quarters:			
Shoulders, smoothly joined with neck and body, broad, compact on top	6		
Breast, broad, carried well forward, closely joined to legs.	4		
Legs, short, straight, strong, well apart; arm full	2		
D. Body:			
Back and loin, straight, broad	8		
Ribs, springing from spine in such a plane as to make back broad and flat	4		
Chest, showing no depression above, at sides, or below, making large girth	6		
Flank, low, full	3		
E. Hind quarters:			
Hips, broad, flat above	4		
Rump, long, level, wide	4		
Thighs, full	5		
Twist, deep, plump	4		
Legs, straight, short, strong, but not coarse	2		
F. Wool:			
Quality, fine for breed, soft, even	3		
Density, great, even	3		
Length, great, even	3		
Yolk, slight amount	1		
Total	100		

College of Agriculture of the University of Minnesota.

This is the same as the Iowa card (see p. 104) for mutton sheep, with the following exceptions: The shoulder is given 2 points, chest 6, and thighs 4, and under fore legs the description of shank reads "smooth, firm."

College of Agriculture and the Mechanic Arts of the University of Missouri.

Scale of points.	Perfect.	Student's estimate.	Corrected.
General appearance:			
Age, as indicated by teeth —; corrected —			
Weight, estimated, — pounds; corrected, — pounds; according to age	6		
Form, square, blocky, low, symmetrical	8		
Quality, skin, thick, soft; color pink; bone clean, fine	8		
Temperament, quiet	5		
	27		
Head and neck:			
Muzzle, fine; mouth large; lips thin; nostrils wide, open	1		
Face, short; expression placid	1		
Eyes, prominent, bright	1		
Forehead, broad	1		
Ears, erect, fine, lively	1		
Neck, short, thick, heavier toward the shoulders	2		
	7		
Fore quarter:			
Shoulder vein, full	2		
Shoulder, compact, well covered with flesh, broad on top	3		
Brisket, projecting, deep, broad; breast wide	3		
Legs, straight, short, well placed outside; arm full, short; bone clean	3		
	11		
Body:			
Chest, deep, thick through the heart	4		
Back, straight, broad, thickly covered with flesh	3		
Loin, thick, broad, well fleshed	3		
Ribs, well sprung, arched, deep	3		
Flank, full, low, thick, making under line straight	3		
	16		
Hind quarter:			
Hips, wide apart, smooth	3		
Rump, long, level, wide	3		
Thighs, full, well fleshed	3		
Twist, deep, full	4		
Legs, straight, short, strong; bone fine, clean	3		
	16		
Constitution:			
Girth, large; estimated, —; corrected, —	3		
Skin, color bright pink	3		
Yolk, abundant, evenly distributed	3		
	9		
Wool:			
Quantity, dense, long, even	6		
Quality, fine, strong, lustrous fiber, without break	4		
Condition, bright, strong, clean	4		
	14		
Total	100		

The Pennsylvania State College.

Scale of points.	Perfect score.	Points deficient.	
		Student's score.	Corrected.
Age, —; teeth, —			
General appearance:			
Weight, estimated, — pounds; actual, — pounds; according to age	6		
Form, low, long, symmetrical, compact	8		
Quality, bone clean, strong; hair silky	8		
Temperament, quiet	5		
Head and neck:			
Muzzle, fine; mouth large; lips thin; nostrils large	1		
Eyes, bright, full	1		
Face, short; expression quiet	1		
Forehead, broad	1		
Ears, fine, erect	1		
Neck, thick, short	1		
Fore quarters:			
Shoulder vein, full	2		
Shoulders, covered, compact	3		
Brisket, projecting forward; breast wide	2		
Legs, straight, short, wide apart, strong; forearm full; shanks smooth	3		
Body:			
Chest, wide, deep	3		
Back, straight, wide	4		
Loin, thick, broad	3		
Ribs, arched, deep	3		
Flank, low, thick, making under line straight	2		
Hind quarters:			
Hips, far apart, smooth	3		
Rump, long, level, wide	3		
Thighs, full	3		
Twist, plump, deep	4		
Purse, full, indicating condition	2		
Legs, straight, short, strong; shank smooth	3		
stitution:			
Girth, large	3		
Skin, color pink	3		
Fleece, dense and even over body; yolk abundant	4		
Wool:			
Quantity, long, dense, even	6		
Quality, fine, soft, pure, even	4		
Condition, bright, strong, clean	4		
Total	100		

Oklahoma Agricultural and Mechanical College.

Scale of points.	Possible score.	Student's score.	Corrected.
General appearance—36 points:			
Weight, estimated, — pounds; actual, — pounds; score according to age	8		
Form, long, level, deep, broad, low set, stylish	10		
Quality, bone clean; hair silky; skin fine; light in offal, yielding large percentage of meat	8		
Condition, deep, even covering of firm flesh, especially in region of valuable cuts; points indicating condition or ripeness are thick dock, back thickly covered with flesh, thick neck, full purse, full, low flank, plump breast	10		
Head and neck—6 points:			
Muzzle, fine; mouth large; lips thin; nostrils large	1		
Eyes, large, clear, placid	1		
Face, short; features clean cut	1		
Forehead, broad, full	1		
Ears, fine, erect	1		
Neck, thick, short, free from folds	1		
Fore quarters—4 points:			
Shoulder vein, full	1		
Shoulder, covered with flesh, compact on top, smooth	1		
Brisket, projecting forward; breast wide	1		
Legs, straight, short, wide apart, strong; forearm full; shank smooth, fine	1		
Body—26 points:			
Chest, wide, deep, full, indicating constitution	8		
Back, broad, straight, long, wide, thickly fleshed; ribs arched	10		
Loin, thick, broad, long	8		
Hind quarters—17 points:			
Hips, far apart, level, smooth	2		
Rump, long, level, wide to tailhead	4		
Thighs, full, deep, wide	5		
Twist, plump, deep	5		
Legs, straight, short, strong; shank smooth, fine	1		
Wool—11 points:			
Kind, domestic, territory, carpet, or blanket			
Class, clothing, delaine, or combing			
Grade, fine, medium, or coarse			
Quantity, long, dense, even	4		
Quality, fine, pure; crimp close, regular, even	3		
Condition, bright, sound, clean, soft, light	4		
Total	100		

WOOL SHEEP.

Iowa State College of Agriculture and the Mechanic Arts.

Scale of points.		Perfect score.
1. Age. —		
General appearance:		
2. Weight		8
3. Form, level, deep, stylish, round rather than square		6
4. Quality, bone clean, fine; hair silky; skin fine		1
Head and neck:		
5. Muzzle, fine; nose broad, wrinkly; pure white		1
6. Eyes, large, clear, placid		1
7. Face, wrinkly, covered with soft velvety coat		1
8. Forehead, broad, full		1
9. Ears, soft thick, velvety		1
10. Neck, short, muscular, well set on shoulders		1
Fore quarters:		
11. Shoulder, strong, deep, broad		4
12. Brisket, projecting forward; breast wide		1
13. Legs, straight, short, wide apart; shank smooth, fine		2
Body:		
14. Chest, deep, full, indicating constitution		10
15. Back, level, long, round ribbed		4
16. Loin, wide, level		4
17. Flank, low, making under line straight		2
Hind quarters:		
18. Hips, far apart, level, smooth		2
19. Rump, long, level, wide		4
20. Legs, straight, short, strong; shank smooth, fine		2
Wool:		
21. Kind, Domestic, clean, bright.		
Carpet } hairy or having dead fibers.		
Blanket }		
Territory, dirty or discolored.		
22. Class, Clothing, fiber under 2 inches in length or unsound.		
Delaine, fiber 2 to 3 inches in length.		
Combing, fiber over 3 inches in length and sound.		
23. Grade, fine, medium, or coarse.		
24. Quantity, long, dense, even, covering especially crown, cheek, armpit, hind leg, and belly		15
25. Quality, fiber, fine, close; quality even, including tops of folds; crimp regular		15
26. Condition, bright, lustrous, sound, pure, soft; distribution of yolk even; even surface to fleece		15
Total		100

Michigan State Agricultural College.

Scale of points.	Stand- ard.	Student's estimate.	Corrected.
A. General appearance:			
Weight, estimated, — pounds; actual, — pounds; standard for mature ram, —; ewe, —	4		
Form, level, deep, round rather than square	5		
Quality, should not be coarse in bone, fleece, or features; firm in handling, yet with soft, pliable skin of bright pink color	6		
Constitution, shown by fleece, skin, girth, and movement	10		
B. Head and neck:			
Muzzle, mouth and nostrils of good size; lips thin	1		
Eyes, bright, prominent; whites clear	2		
Face, short, except in Oxfords, Hampshires, and Cotswolds	1		
Forehead, broad, full	2		
Ears, well apart, covered with fine soft hair, in size and form typical of breed	1		
Neck, for M., short, thick, neatly tapering to head; for W., longer, drooping at yoke	1		
C. Fore quarters:			
Shoulders, for M., smoothly joined with neck and body, broad on top, compact; for W., less closely joined	4		
Breast, broad, carried well forward, closely joined to legs	3		
Legs, short, straight, strong, well apart; arm full	2		
D. Body:			
Back and loin, straight, broad	5		
Ribs, springing from spine in such a plane as to make back broad and flat; for wool, slope downward from spine	2		
Chest, showing no depression above, at sides, or below, making large girth	4		
Flank, low, full	2		
E. Hind quarters:			
Hips, broad, flat above	2		
Rump, long, level, wide	2		
Thighs, full, less so for W.	2		
Twist, deep, plump	2		
Legs, straight, short, strong, but not coarse	2		
F. Wool:			
Quality, fine for breed, soft, even	12		
Density, great, even	10		
Length, great, even	10		
Yolk, slight amount	3		
Total	100		

POULTRY.

Kansas State Agricultural College.

	Possible score.		Student's score.		Judge's score.		Remarks.
	Shape.	Color.	Shape.	Color.	Shape.	Color.	
Typical carriage							
Weight and size							
Condition							
Head							
Comb							
Eyes							
Ear lobes and wattles							
Neck							
Back							
Tail							
Breast							
Body and fluff							
Wings							
Legs and toes							
Crest and beard							
Hardness of feather							
Total outs							
Total score							

Cornell University.

Scale of points.	Perfect score.			Deficient.	
	Ameri- can.	Asiatic.	Medi- terran.	Student's estimate.	Cor- rected.
Typical carriage	8	8	8		
Weight or size	6	6	10		
Condition	6	6	5		
Head:					
Shape	3	3	2		
Color	3	3	2		
Comb	8	8	10		
Wattles and ear lobes	6	6	{ w. 4 e. l. 6 }		
Neck:					
Shape	4	4	3		
Color	6	6	4		
Back:					
Shape	5	4	3		
Color	5	4	4		
Breast:					
Shape	5	5	6		
Color	5	5	4		
Body and fluff:					
Shape	3	5	3		
Color	3	3	3		
Wings:					
Shape	4	4	4		
Color	4	4	4		
Tail:					
Shape	4	4	4		
Color	4	4	4		
Legs and toes	8	8	7		
Total	100	100	100		

North Dakota Agricultural College.^a

Symmetry—typical shape		Body and fluff:	
Weight		Shape	
Condition		Color	
Comb		Wings:	
Eyes		Shape	
Head:		Color	
Shape		Tail:	
Color		Shape	
Wattles and ear lobes:		Color	
Shape		Legs and toes:	
Color		Shape	
Neck:		Color	
Shape		Crest and beard:	
Color		Shape	
Back:		Color	
Shape		Hardness of feather	
Color			
Breast:		Score	
Shape			
Color			

^aNorth Dakota and Northern Minnesota Poultry Association. A. P. A. standard score card.

The Pennsylvania State College.

Scale of points.	Perfect score.			Deficient.	
	Ameri- can.	Asiatic.	Mediterranean.	Student's estimate.	Cor- rected.
Typical carriage	8	8	8		
Weight or size	6	6	10		
Condition	6	6	5		
Head:					
Shape	3	3	2		
Color	3	3	2		
Comb	8	8	10		
Wattles and ear lobes	6	6	{ w. 4 e. l. 6 }		
Neck:					
Shape	4	4	3		
Color	6	6	4		
Back:					
Shape	5	4	3		
Color	5	4	4		
Breast:					
Shape	5	5	6		
Color	5	5	4		
Body and fluff:					
Shape	3	5	3		
Color	3	3	3		
Wings:					
Shape	4	4	4		
Color	4	4	4		
Tail:					
Shape	4	4	4		
Color	4	4	4		
Legs and toes	8	8	7		
Total	100	100	100		

Rhode Island College of Agriculture and the Mechanic Arts.

[The decimal score card. Copyright by I. K. Felch.]

Date Sex
 Breed
 Entry No. Coop No. Weight
 Ring No.

Directions for
using this card.

Owner and exhibitor. Each section 10 points.	Condition, weight, or size		To cut for weight, comb, head, legs, check (x) the feature defective and cut in the column. For shape, make cut above the dotted line. For color, below the line. Shape being more defective than color, cut in space for shape, but low enough to include the dotted lines. Color being the greater evil, commence figure just above the dotted line and carry deep down into columns or space. This secures dispatch in its use for exhibitions.
	Comb, or crest and comb		
	Head and adjuncts:		
	Beak		
	Eye		
	Ear lobe		
	Wattles		
	Neck:		
	Shape		
	Color		
	Back:		
	Shape		
	Color		
	Breast:		
	Shape		
	Color		
	Body and fluff:		
	Shape		
	Color		
	Wings:		
	Shape		
	Color		
	Tail:		
	Shape		
	Color		
	Legs and toes:		
	Shape		
	Plumage		
	Color		
	Total defects		Score

Judge.

Pres.

Secy.

Rhode Island Agricultural College.

FOR BREEDING PEN.

[Copyright by I. K. Felch.]

Breed					
Sex					
Weight					
Ring No					
Condition, weight, or size					
Comb, or crest and comb					
Head and adjuncts:					
Beak					
Eye					
Ear lobe					
Wattles					
Neck:					
Shape					
Color					
Back:					
Shape					
Color					
Breast:					
Shape					
Color					
Body and fluff:					
Shape					
Color					
Wings:					
Shape					
Color					
Tail:					
Shape					
Color					
Legs and toes:					
Shape					
Plumage					
Color					
Total defects					
Score					

..... Judge.

DRESSED CARCASSES AND BLOCK TESTS.

BEEF CATTLE—CARCASS EXAMINATION.

College of Agriculture of the University of Minnesota.

	Scale of points.	Perfect score.
General appearance:		
1. Covering, even, smooth, firm, white		5
2. Form, compact, well filled out		10
3. Quality, flesh deep, even, firm; grain fine; texture firm but yielding to pressure; bone dense, fine; fat and lean well mixed		20
4. Kidney fat, firm, white, brittle, in proportion to covering		5
Fore quarters:		
5. Neck, short, neat		1
6. Shoulder, compact, well covered		2
7. Chuck ribs, not coarse; meat thick		6
8. Prime ribs, flesh deep, carried well down, firm, evenly covered with medium thick fat		12
9. Plate, light, not coarse		3
10. Shank, arm full; bone fine		1
Hind quarters:		
11. Loin, flesh firm, even, deep; fat and lean well mixed; spine fat medium thick		18
12. Rump, full and evenly fleshed to tailhead		4
13. Round, flesh thick, carried well down, well mixed with fat		10
14. Flank, thick, well filled		2
15. Shank, bone fine, dense		1
Total		100

BLOCK RECORD.

Name of animal	Type
Breeding	Sex
Live weight	Dressed weight
Shop No.	Per cent dressed carcass to live weight
Age	

Date		Cut by		Date		Cut by	
Left hind quarter—weight				Right hind quarter—Weight			
	Gross.	Marketable meat (retail).	Fat.	Bone and trimmings.	Per cent marketable meat in dressed carcass.	Per cent marketable meat in live animal.	
Round:							
a Round steak							
b Rump							
c Pot roast							
d Shank							
Fat							
Total							
Loin:							
e Sirloin steak							
f Porterhouse stk							
g Sirloin strip							
h Suet							
i Flank							
Total							
Left front quarter—weight				Right front quarter—weight			
Ribs:							
j Prime							
k Chuck							
Total							
Chuck:							
l Shoulder							
m Cross rib							
n Plate							
o Neck							
p Shank							
Total							
Grand total weight and per cent of marketable meat to weight of carcass							

NOTES ON CARCASS.

	Stand-ard.	Stu- dent's.	Cor- rect.	
Grain of meat	20			Marketable meat in a, b, c, f, g, j.
Mixture of fat and lean	20			Marketable meat in c, d, i, k, l, m, n, o, p.
Texture of lean	20			Remarks:
Color of lean	10			
Texture of fat	10			
Color of fat	10			
Flavor	10			
Total	100			

LARD HOGS—CARCASS EXAMINATION.

College of Agriculture of the University of Minnesota.

	Scale of points.	Perfect score.
General appearance:		
1. Skin, thin, mellow, soft		5
2. Form, thick, deep; length medium		10
3. Quality, flesh deep, even, firm; bone dense		20
4. Kidney fat, abundant, white, firm		5
Carcass:		
Head, fine, neat, short		2
Neck, short, full		3
Shoulder, compact, well covered		10
Side, deep, thick, evenly fleshed, firm; loin heavy		25
Ham, large, plump, fleshed well down, firm		20
Total		100

BLOCK RECORD.

Shop No.	Live weight
Type	Dressed weight
Age	Per cent yield of carcass
Breeding	Date cut
Sex	Cut by

Major and minor cuts.	Weights.				
Head:					
Check meats					
Refuse					
Minor total					
Total per cent					
Shoulder:					
Butt (loin)					
Butt (fat)					
Neck spare rib					
Legs					
California ham					
Trimming					
Minor totals					
Offal or waste					
Total per cent					
Middle:					
Kidney fat					
Loin					
Fat back					
Spare rib					
Prime bacon					
Bacon trimmings					
Minor totals					
Total per cent					
Hams:					
Prime hams					
Trimming					
Leg					
Minor totals					
Total per cent					
Grand total per cent					

BACON HOGS—CARCASS EXAMINATION.

College of Agriculture of the University of Minnesota.

Scale of points.	Perfect score.
General appearance:	
1. Skin, thin, mellow, smooth.....	5
2. Form, long, deep in proportion to thickness.....	10
3. Quality, flesh, firm, even, streaked with fat and lean; back fat, thin; bone dense....	20
4. Kidney fat, white, firm.....	5
Carcase:	
Head, fine, neat, longer than in lard hog.....	2
Neck, short, not heavy.....	3
Shoulders, smooth, well covered.....	10
Sides, long, deep, evenly fleshed, firm; loin heavy.....	25
Ham, large, plump, firm; light covering of fat.....	20
Total	100

MUTTON SHEEP—CARCASS EXAMINATION.

College of Agriculture of the University of Minnesota.

Scale of points.	Perfect score.
General appearance:	
1. Covering, even, smooth, firm, dry, white.....	5
2. Form, long but compact; well filled in loin and leg.....	10
3. Quality, flesh deep, even, firm, fine grained, not stringy; bone dense; fat evenly distributed, free from rolls.....	20
4. Kidney fat, firm, white, brittle, in proportion to covering.....	5
Body:	
5. Neck, short, neat.....	2
6. Plate, light, not coarse.....	3
7. Shoulders, compact, well covered.....	5
8. Rack, muscle deep, firm, even, carried well down; fat evenly distributed, medium thick.....	15
9. Loin, muscle firm, abundant; fat medium thick.....	15
10. Leg, plump, thick, fleshed well down.....	20
Total	100

BLOCK RECORD.

Shop No.....	Per cent yield.....
Age.....	Date.....
Sex.....	Cut by.....
Live weight.....	Left half weight.....
Dressed weight.....	Right half weight.....

	Gross weight.	Marketable meat (re-tail).	Bone and trimmings.	Fat.	Gross.	Marketable meat (re-tail).	Bone and trimmings.	Fat.	Total gross weight.	Total marketable meat weight.	Per cent marketable meat to live weight.	Per cent marketable meat to dressed weight.
Hind leg.....1												
Rack and loin.....2												
Kidney fat.....3												
Plate and flank.....4												
Front leg.....5												
Shoulder.....6												
Neck.....7												

Grand total weight and per cent of marketable meat to weight of carcass.....
 Marketable meat in cuts 1 and 2.....
 Marketable meat in cuts 4, 5, 6, and 7.....

ANIMAL MECHANICS.

HORSES.

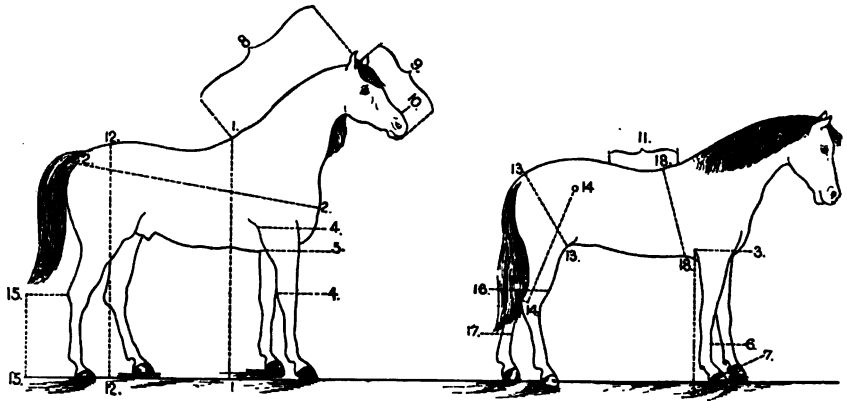
New Hampshire College of Agriculture and the Mechanic Arts.^a

FIG. 10.—Chart for study of proportions of the horse.

Fig.—			Inches.	
1	1	1	Height at withers	
2	2	2	Length from point of shoulder to quarter	
2	3	3	From lowest point of chest to the ground	
2	3	3	From the point of elbow to the ground	
1	4	4	From the point of elbow to trapezium	
			From trapezium to ground	
1	5		Circumference of the arm	
2	6		Circumference of cannon in center	
2	7		Circumference of foot at coronet	
1	8		From point of withers to occiput	
1	9		Length of head	
			Width of forehead	
1	10		Circumference of muzzle at angle of mouth	
			Width of chest from outside of shoulder points	
2	11		Length of back from point of withers to point of croup	
			Width across hips	
1	12	12	Height to highest point of croup	
2	13	13	From center of dock to anterior point of patella	
2	14	14	From point of hock to point of hip	
2	15	15	From point of hock to ground	
2	16		Circumference of thigh	
2	17		Circumference of shank in the center	
2	18	18	Circumference of body at the girth	
			Length of croup	
			Height of crest of occiput from ground	
			Dorsal angle of scapula to hip	
			From angle of lower jaw to forehead above eye	
			From throat to superior border of neck	

^aAlso used by North Carolina College of Agriculture and Mechanic Arts.

Cornell University.

	Inches.	
Height at withers.....		
Height to highest point of croup.....		
Length from point of shoulder to quarter.....		
From lowest point of chest to the ground.....		
From the point of elbow to the ground.....		
From the point of elbow to trapezium.....		
From trapezium to ground.....		
Circumference of the arm.....		
Circumference of cannon in center.....		
Circumference of foot at coronet.....		
Length of head.....		
Width of forehead.....		
Circumference of muzzle at angle of mouth.....		
Width of chest from outside of shoulder points.....		
Width across hips.....		
From center of dock to anterior point of patella.....		
From point of hock to point of hip.....		
From point of hock to ground.....		
Circumference of thigh.....		
Circumference of shank in the center.....		
Circumference of body at the girth.....		
Length of croup.....		
Height of crest of occiput from ground.....		
Dorsal angle of scapula to hip.....		
From angle of lower jaw to forehead above eye.....		
From throat to superior border of neck.....		

The College of Agriculture and Domestic Science, Ohio State University.^a

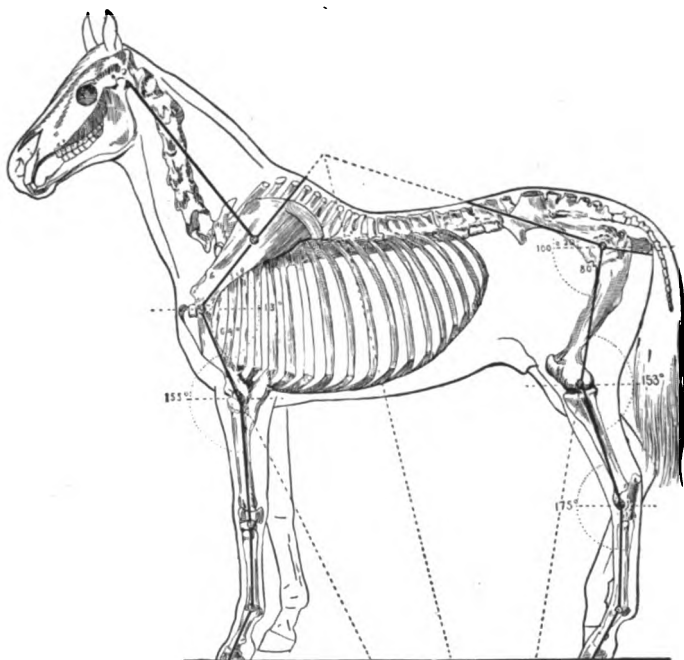


FIG. 11.—Chart for study of articular angles of the horse.

	Degrees.
Inclination upon the horizon:	
Scapular	
Humeral	
Iliac	
Femoral	
Tibial	
Cephalic	
Cervical	
Articular angles in stations:	
Scapulo-humeral	
Humero-radial	
Metacarpo-phalangeal	
Ilio-femoral	
Femoro-tibial	
Tibio-metatarsal	
Metatarso-phalangeal	
Cervico-cephalic	
Attitudes in station:	
Anterior members viewed in profile	
Anterior members viewed in front	
Posterior members viewed in profile	
Posterior members viewed from behind	

^a Also used by Cornell University.

CATTLE.

College of Agriculture and Mechanic Arts of the University of Missouri.

Date								
Name of animal								
Breed								
Age								
Condition								
Sex								
Color and markings								
Weight								
Height at withers								
Height at highest point of croup								
Height of foreflank								
Length of foreleg from elbow to ground								
Smallest circumference of shin bone								
Height of hind flank								
Length from point of hock to ground								
Length from base of horns to withers								
From highest point of withers to a line between the hips								
From point of shoulder to point of hips								
From a line between hips to the tail								
Length of a perpendicular line from withers to a point opposite the point of the shoulders								
Depth of chest								
Width of chest								
Girth of throatlatch								
Width of jaws (measure from outside)								
Length from poll to point of muzzle								
Length of face from line between eyes to point of muzzle								
Width of forehead								
Largest circumference of muzzle								
Heart girth								
Girth of middle of paunch								
Girth at the flank								
From point of hip to ischium								
From point of hips to last ribs								
Width of hips								
Width of pin bones								
From point of hip to point of hock								
Weight of fore quarters								
Weight of hind quarters								

The College of Agriculture and Domestic Science, Ohio State University.

	Inches.	
Height at the withers		
Height at highest point of croup		
Height of foreflank		
Height of flank		
Length from the base of horns to the withers		
From the highest point of withers to a line between the hips		
From a line between hips to the tail		
Length of a perpendicular line from withers to a point opposite the point of the shoulders		
Girth of throatlatch		
Heart girth		
Girth of middle of paunch		
Girth at the flank		
From point of hip to ischium		
From point of hips to last ribs		
Width of hips		
From point of hip to point of hock		
Weight of forequarters		
Weight of hind quarters		

MARKET REPORTS.**BEEF CATTLE.****College of Agriculture of the University of Illinois.**

Classes.	Grades.	Prices per hundredweight.					
		Mon-day.	Tues-day.	Wednes-day.	Thurs-day.	Fri-day.	Satur-day.
Beef cattle.....	Prime steers.....						
Remarks:	Choice steers.....						
	Good steers.....						
	Medium steers.....						
	Common rough steers.....						
Butcher stock.....	Prime heifers.....						
Remarks:	Choice heifers.....						
	Good heifers.....						
	Medium heifers.....						
	Prime cows.....						
	Choice cows.....						
	Good cows.....						
	Medium cows.....						
	Common rough steers.....						
	Choice bulls.....						
	Good bulls.....						
	Medium bulls.....						
Cutters and canners....	Good cutters.....						
Remarks:	Medium cutters.....						
	Common cutters and good canners.....						
	Medium canners.....						
	Inferior canners.....						
	Bologna bulls.....						
Stockers and feeders ..	Fancy selected feeders.....						
Remarks:	Choice feeders.....						
	Good feeders.....						
	Medium feeders.....						
	Common feeders.....						
	Inferior feeders.....						
	Feeder bulls.....						
	Fancy selected yearling stockers.....						
	Choice yearling stockers.....						
	Good yearling stockers.....						
	Medium yearling stockers.....						
	Common yearling stockers.....						
	Inferior yearling stockers.....						
	Good stock heifers.....						
	Medium stock heifers.....						
	Common stock heifers.....						
Veal calves.....	Choice.....						
Remarks:	Good.....						
	Medium.....						
	Common.....						

EFFICIENCY OF MILKING.**The Connecticut Agricultural College. ^a**

A. 1. Regularity of milking.....	3
2. Rapidity of milking.....	12
3. Thoroughness of milking.....	12
4. Quietness while milking.....	3
B. 1. Amount of milk produced by cows.....	16
2. Amount of fat produced by cows.....	3
3. Accuracy of weighing.....	1
4. Accuracy of recording.....	1
5. Accuracy of sampling and Babcock testing.....	10
C. Sanitary milking:	
1. Concerning the milker—	
(a) Milker should wear a clean white suit.....	2
(b) Milker must have clean hands.....	2
(c) Milking with dry hands.....	2
2. Concerning the cow—	
(a) Preparation of the cow for milking.....	8
(b) Prevention of contamination while milking—	
Wipe flank and udder of cow with damp cloth.....	2
Reject fore milk.....	2
Use of covered milk pail.....	2
3. Determination of germ content of milk—	
(a) Number of germs.....	20
Total.....	100

^a An. Rpt., Storrs Expt. Sta., 1902-03.

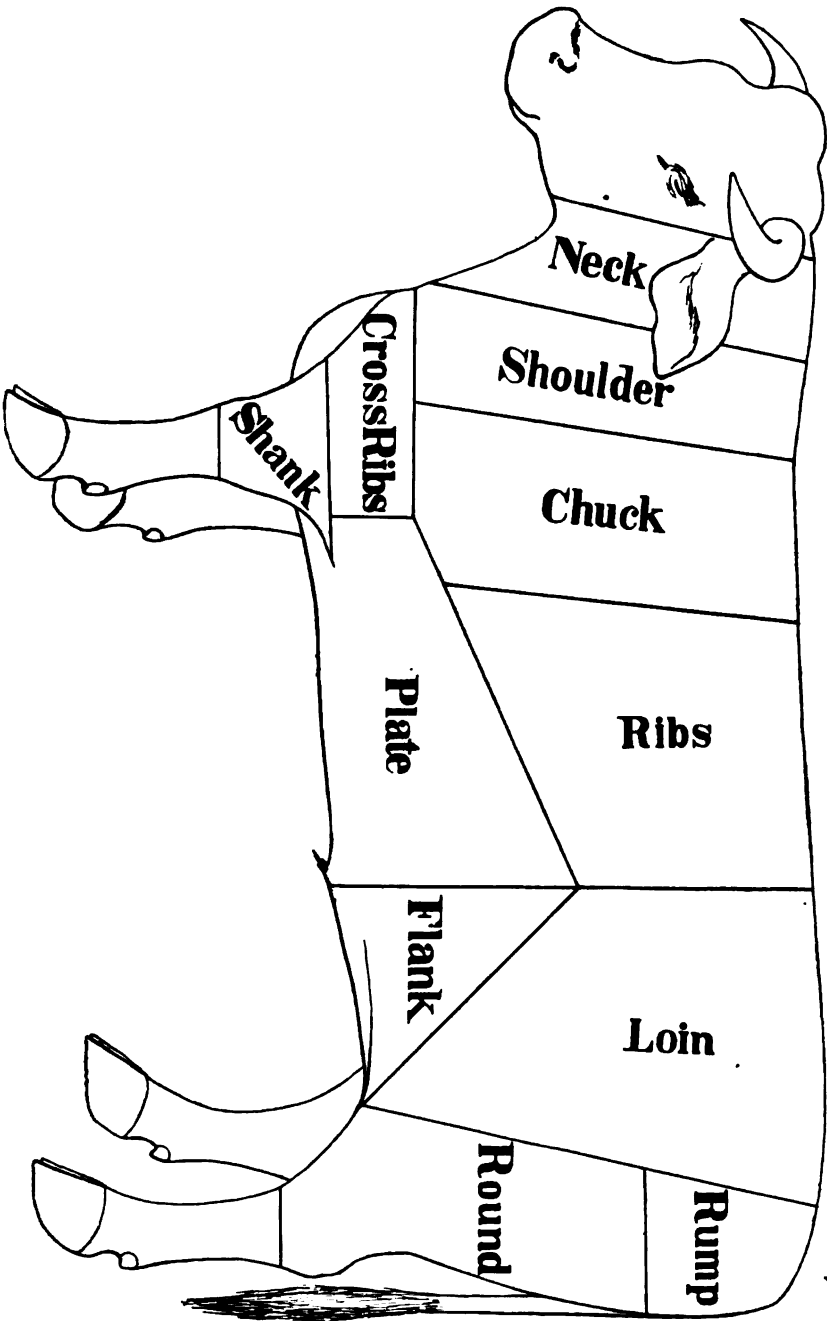


DIAGRAM OF STEER, SHOWING MINNESOTA METHOD OF CUTTING CARCASS.

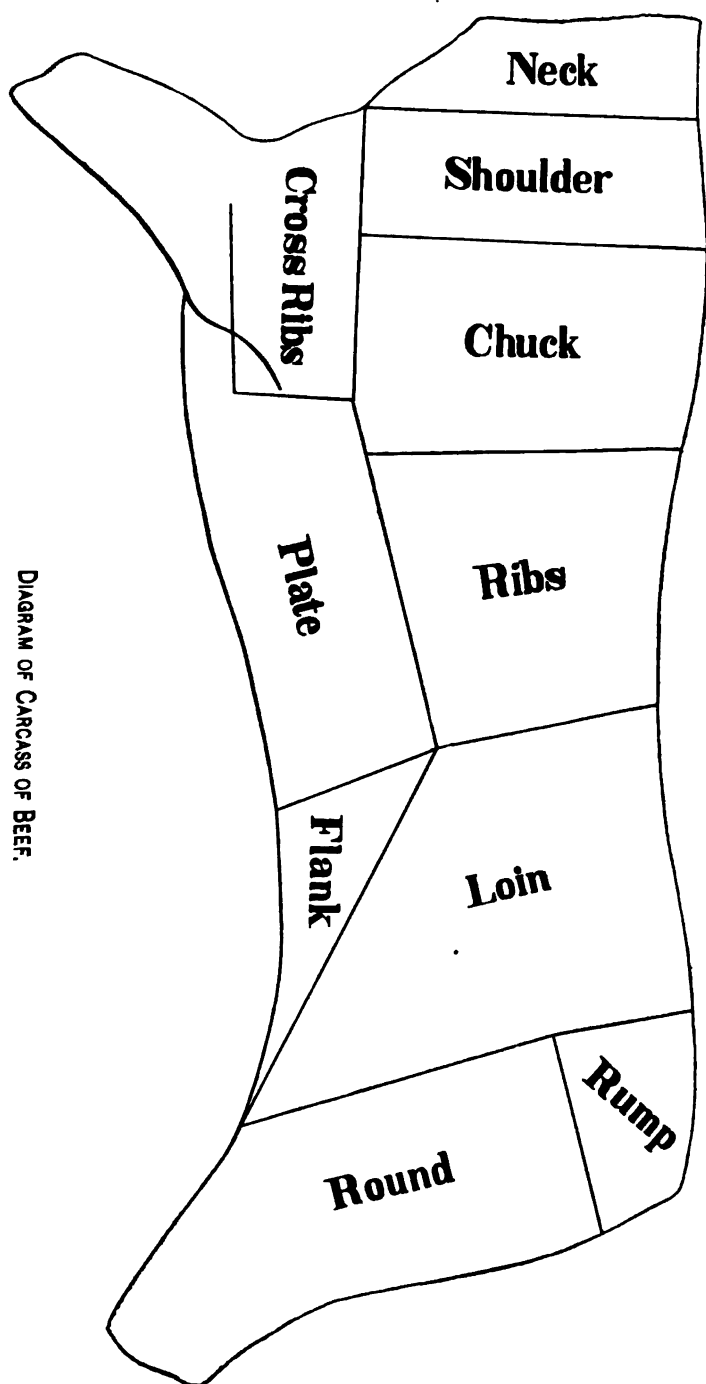
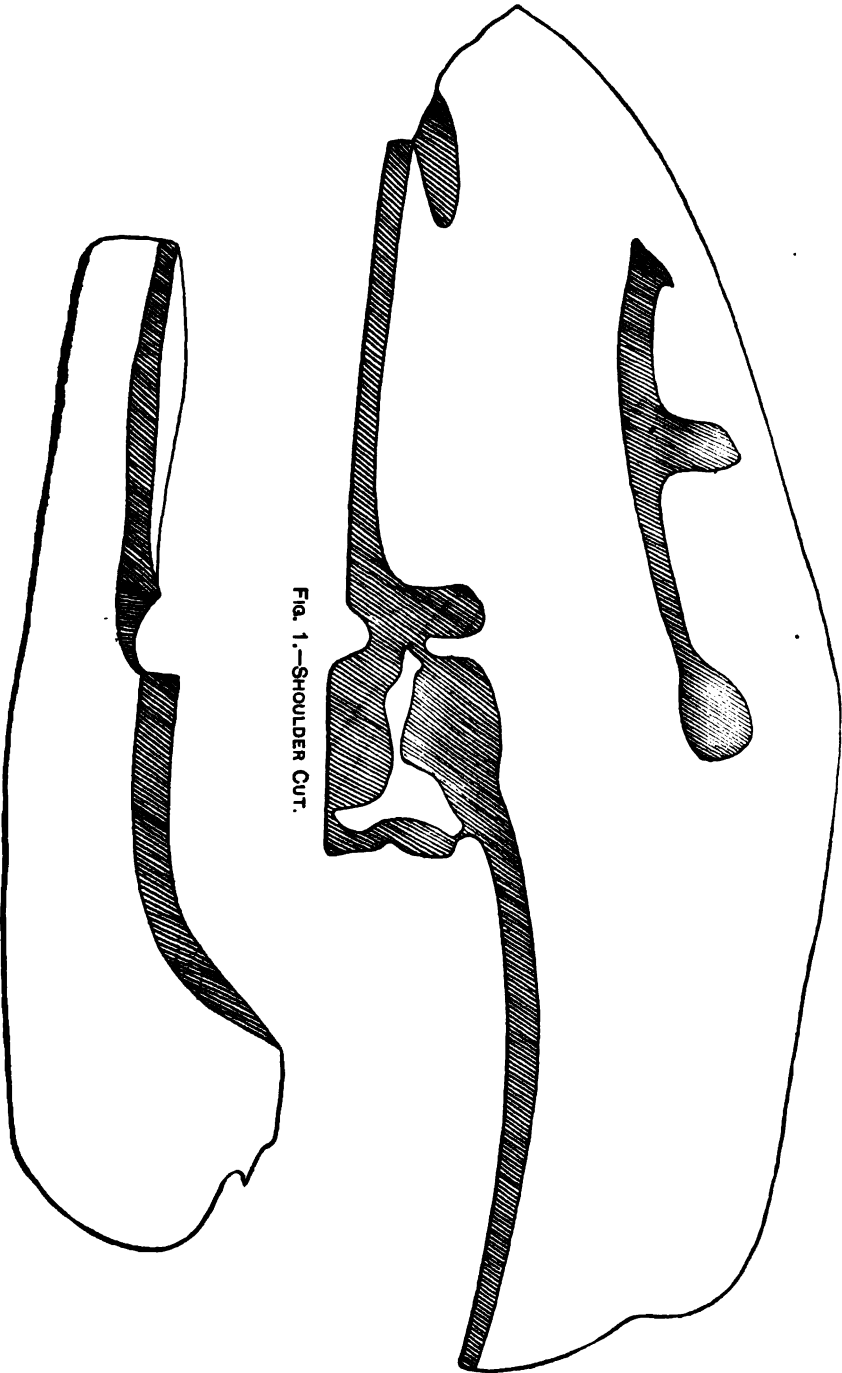


DIAGRAM OF CARCASS OF BEEF.

FIG. 1.—SHOULDER CUT.

FIG. 2.—FOLDED ROAST.



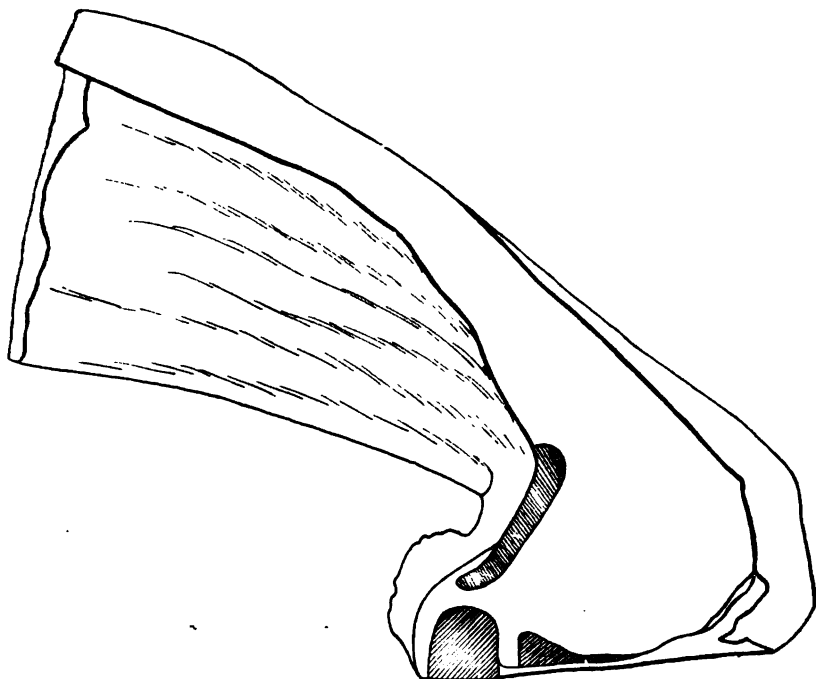


FIG. 1.—SMALL END RIBS.

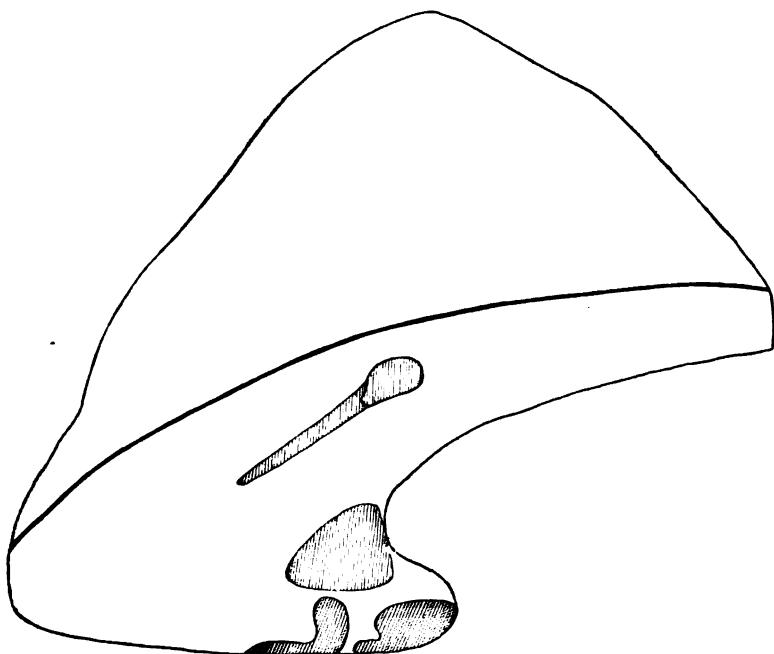


FIG. 2.—LARGE END RIBS.

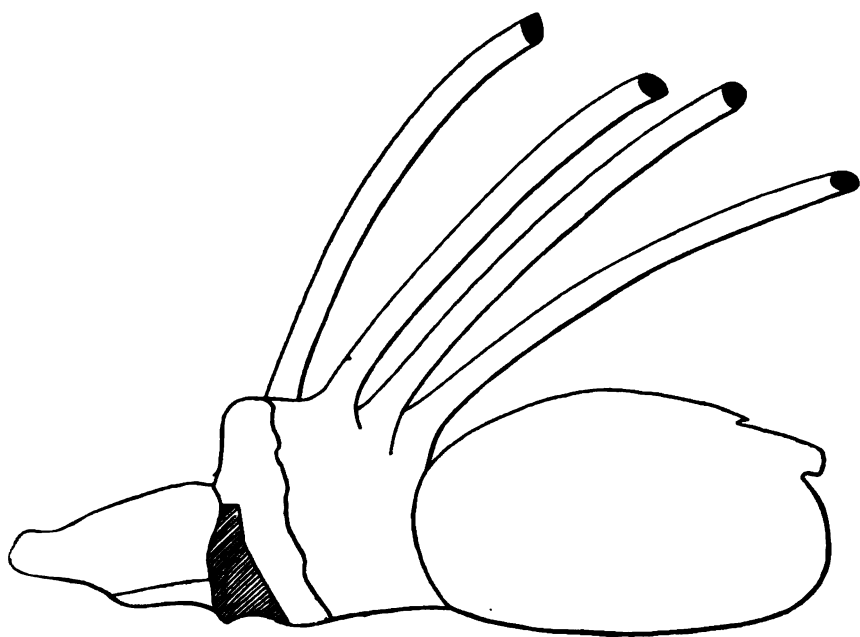


FIG. 1.—ROLLED ROAST.

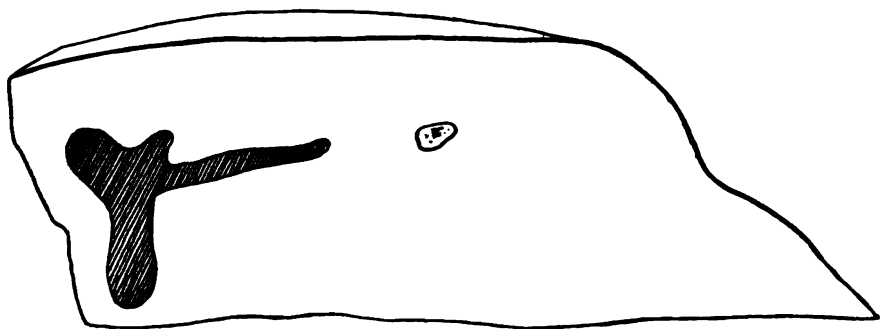


FIG. 2.—PORTERHOUSE STEAK.

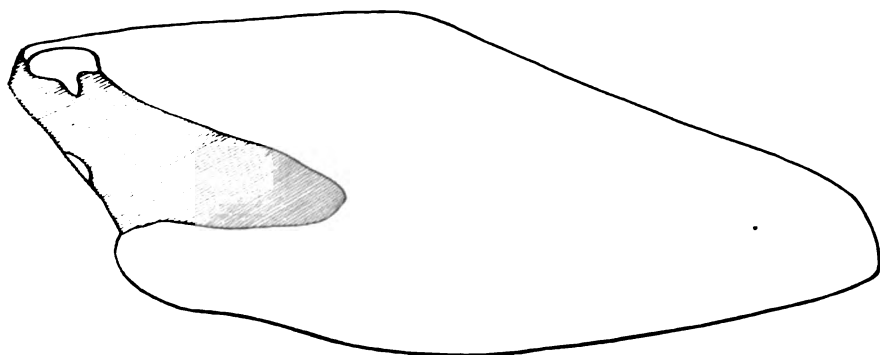


FIG. 1.—WEDGE-BONE SIRLOIN.

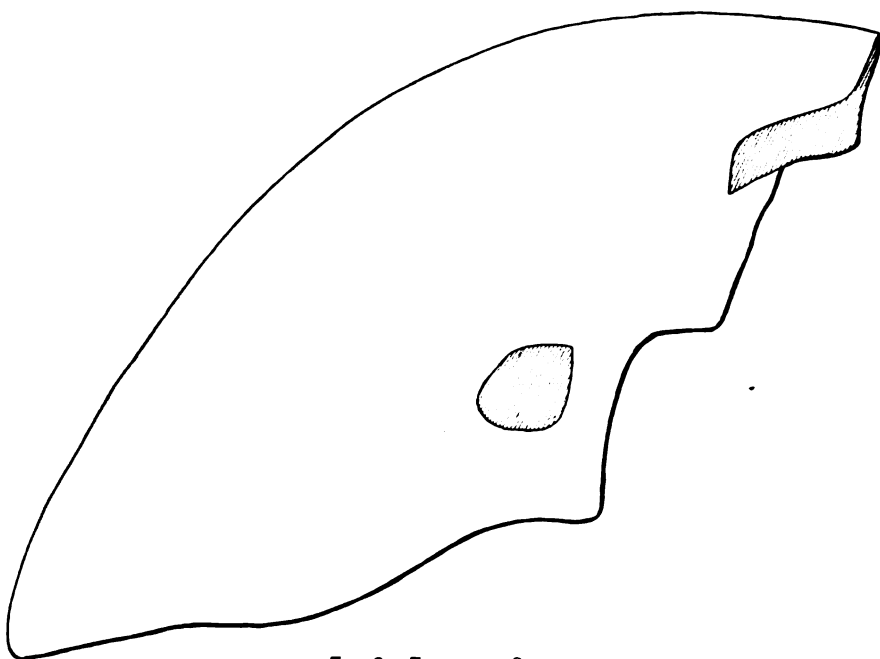


FIG. 2.—FIRST-CUT SIRLOIN.

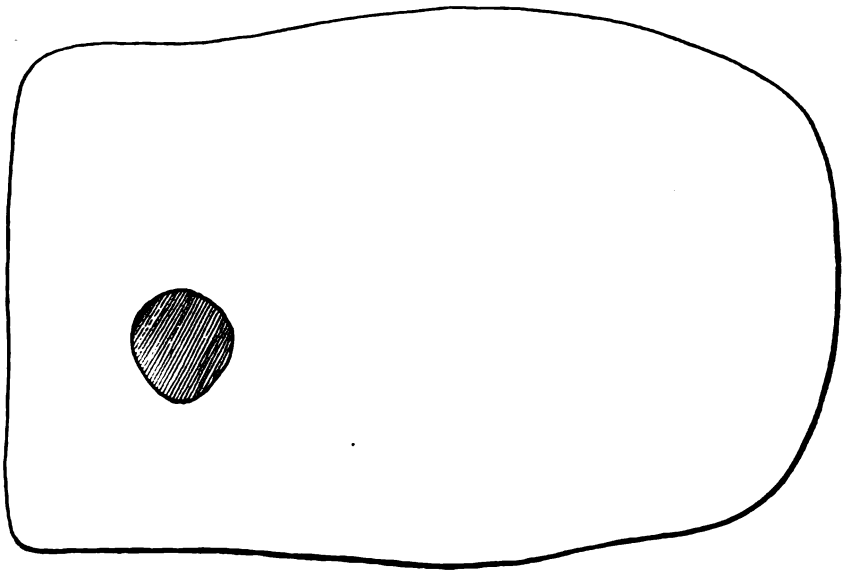


FIG. 1.—FIRST CUT OF ROUND.

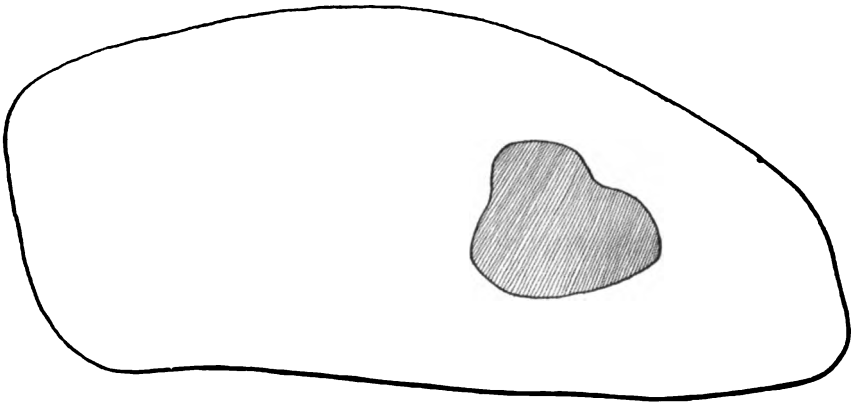


FIG. 2.—LAST CUT OF ROUND.

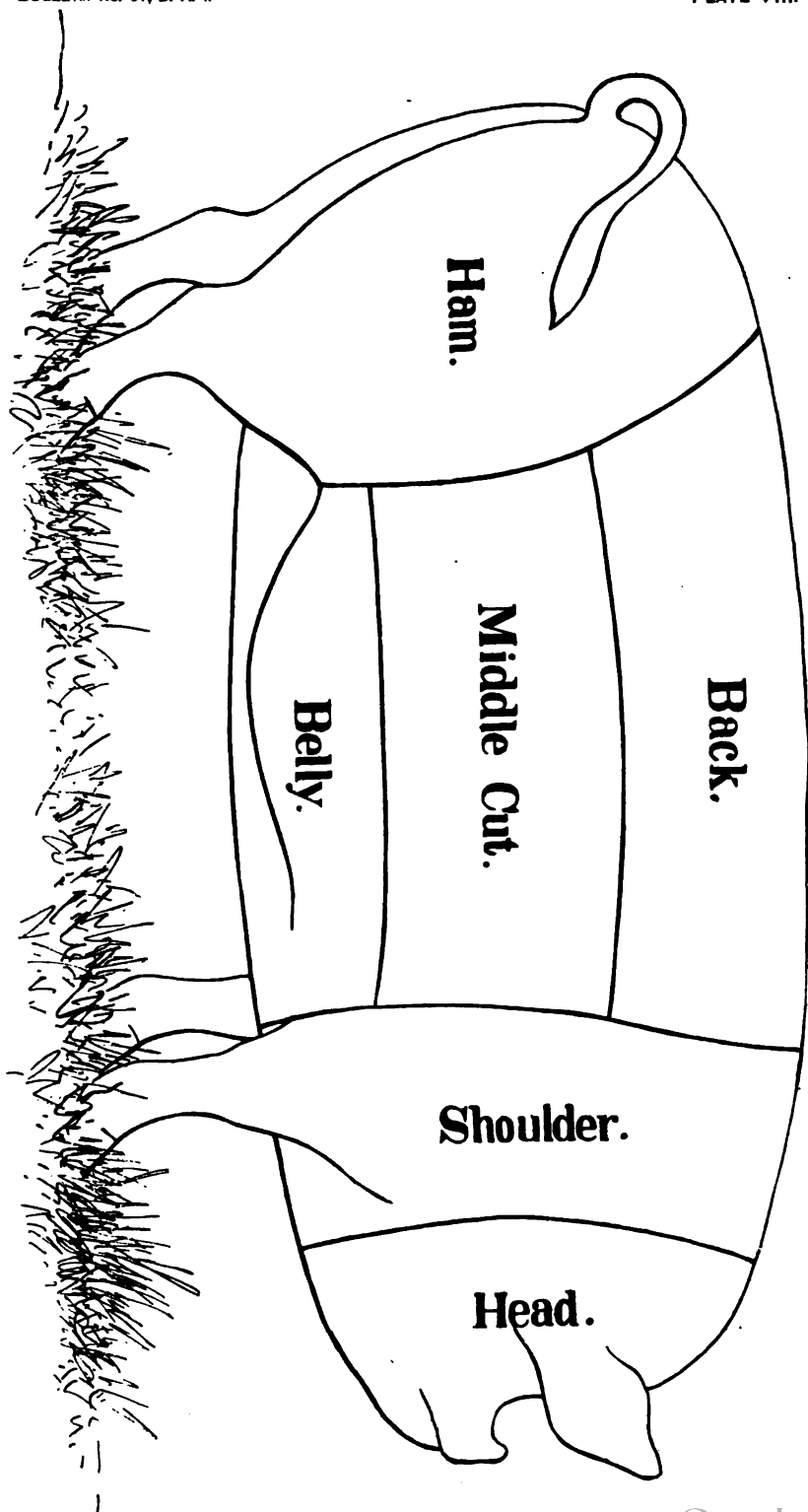


DIAGRAM OF HOG SHOWING MINNESOTA METHOD OF CUTTING CARCASS.

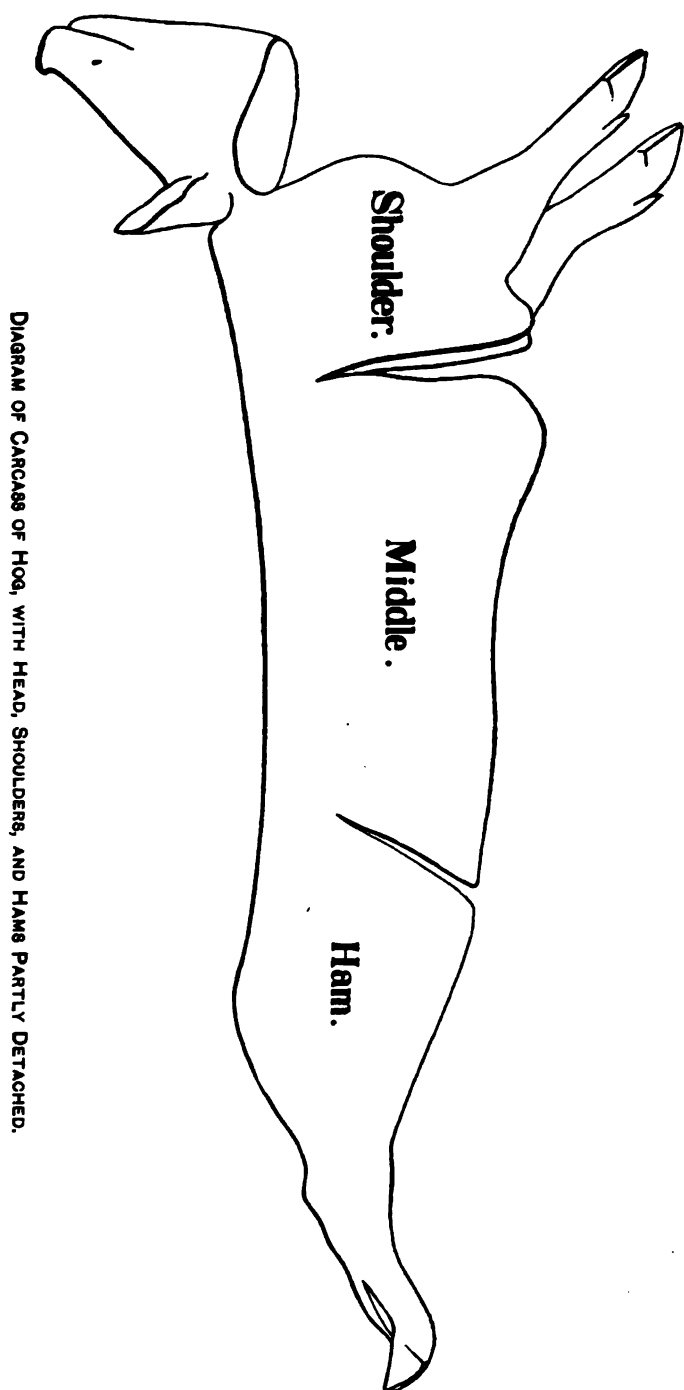


DIAGRAM OF CARCASS OF HOG, WITH HEAD, SHOULDERS, AND HAM PARTLY DETACHED.

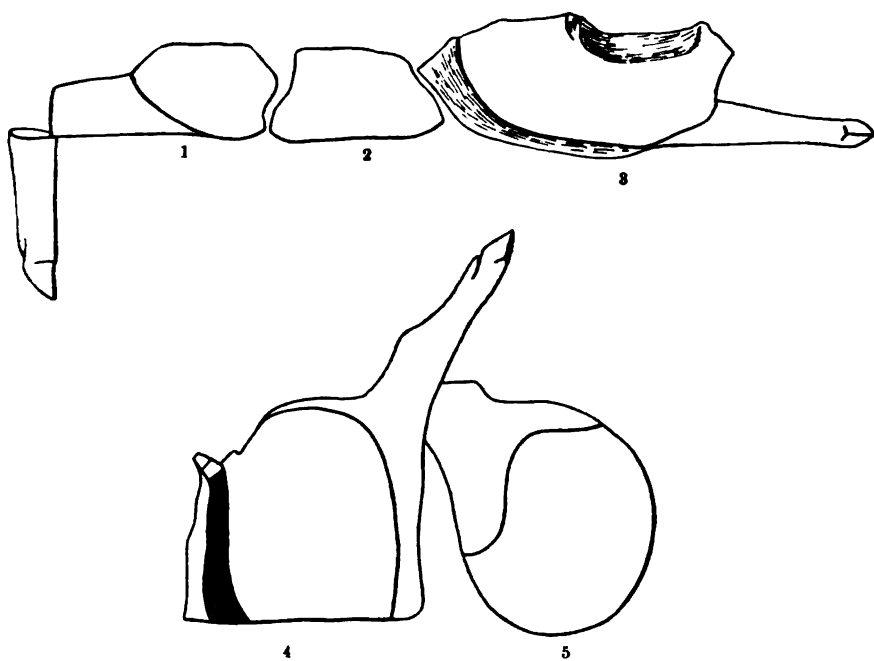


FIG. 1.—CALIFORNIA HAM. FIG. 2.—SHOULDER BUTT. FIG. 3.—SHOULDER, UNTRIMMED.
FIG. 4.—HAM, UNTRIMMED. FIG. 5.—HAM, TRIMMED.

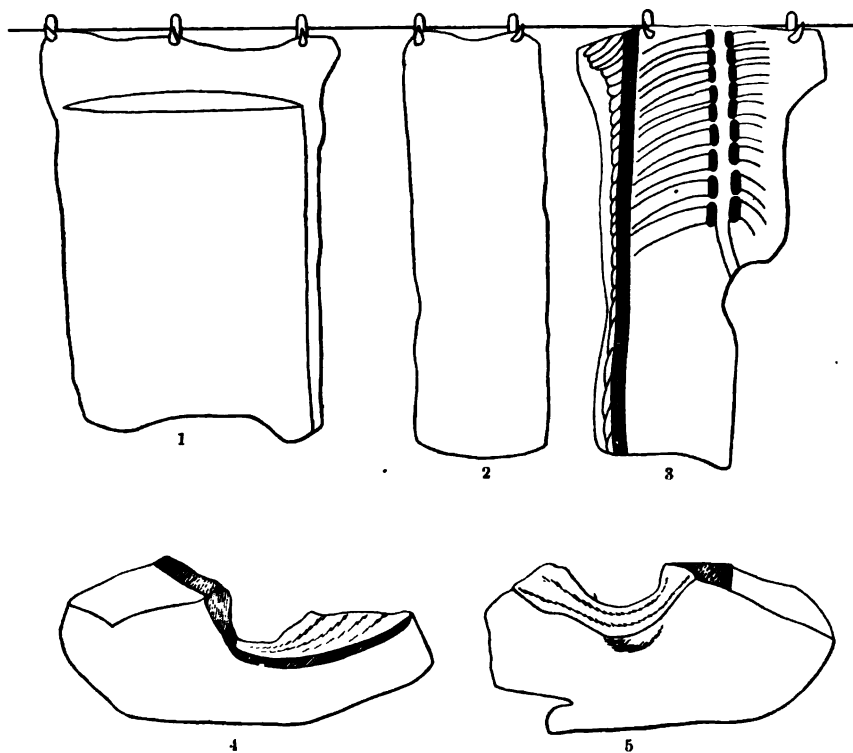


FIG. 1.—BACON STRIP. FIG. 2.—FAT BACK. FIG. 3.—SPARERIBS AND LOIN.
FIG. 4.—LARGE END OF MIDDLE. FIG. 5.—SMALL END OF MIDDLE.

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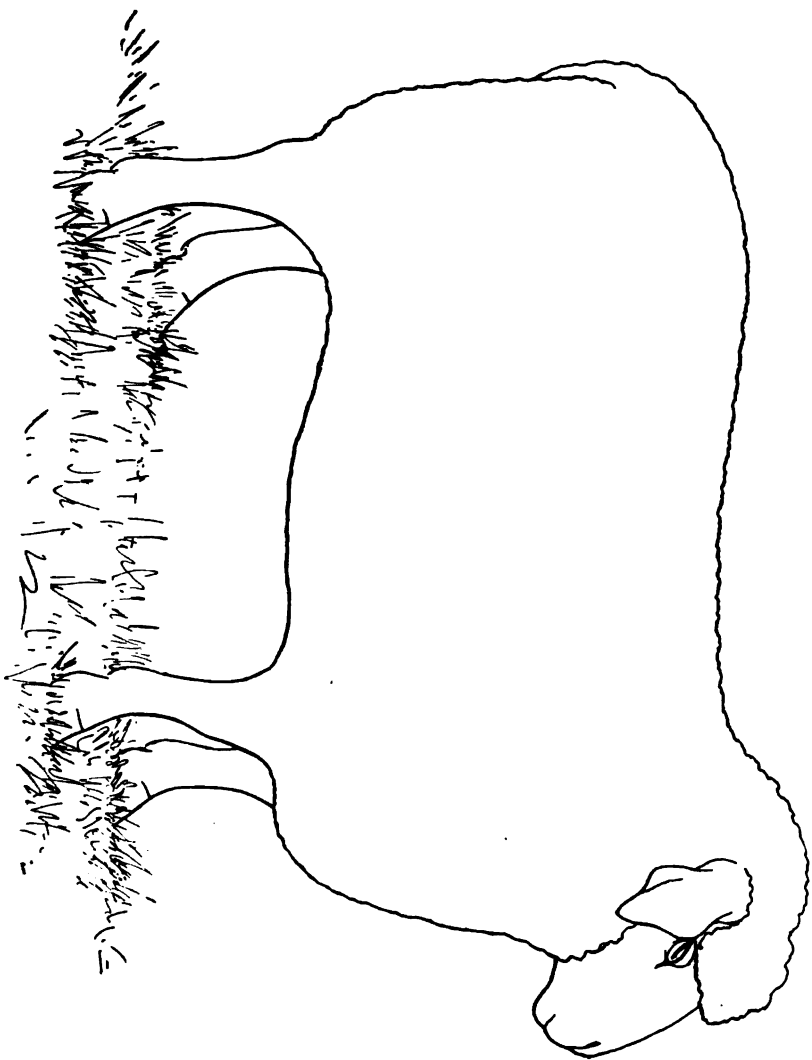


DIAGRAM OF SHEEP (MINNESOTA CHART).

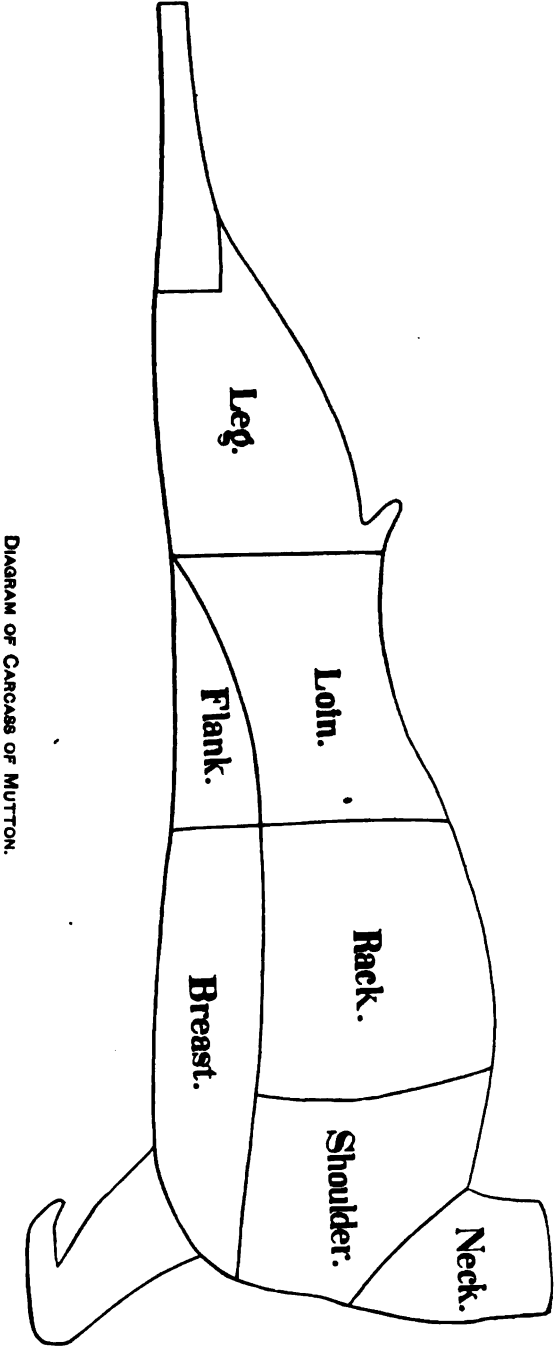


DIAGRAM OF CARCASS OF MUTTON.

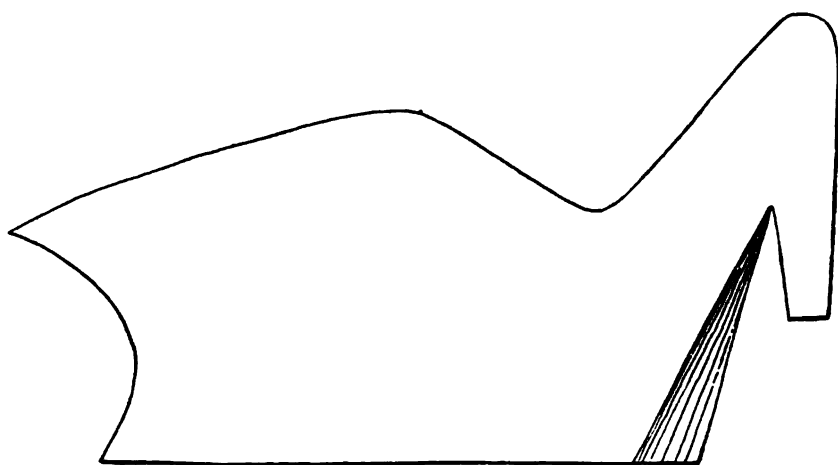


FIG. 1.—SHOULDER, UNTRIMMED.

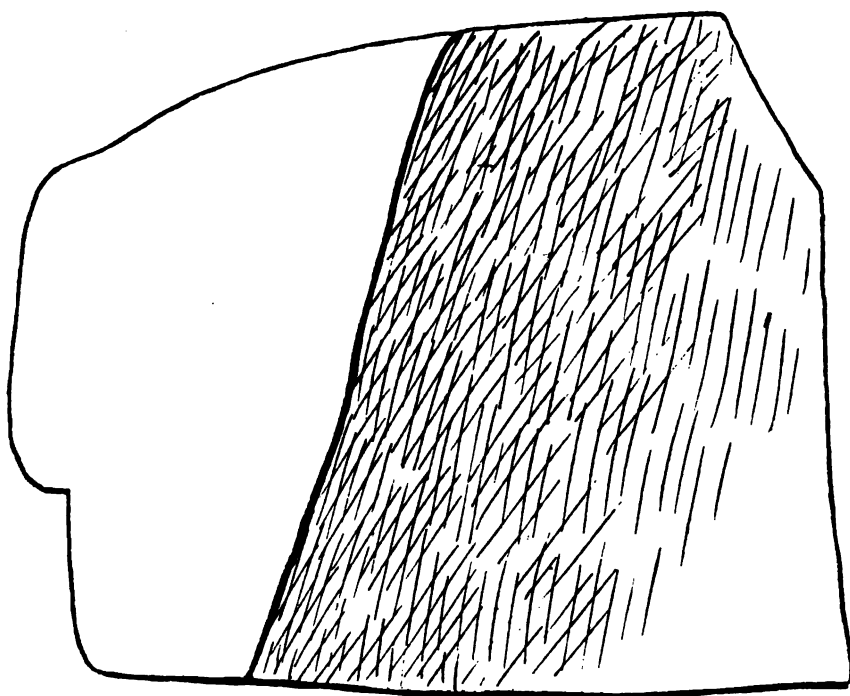


FIG. 2.—SHOULDER, TRIMMED.

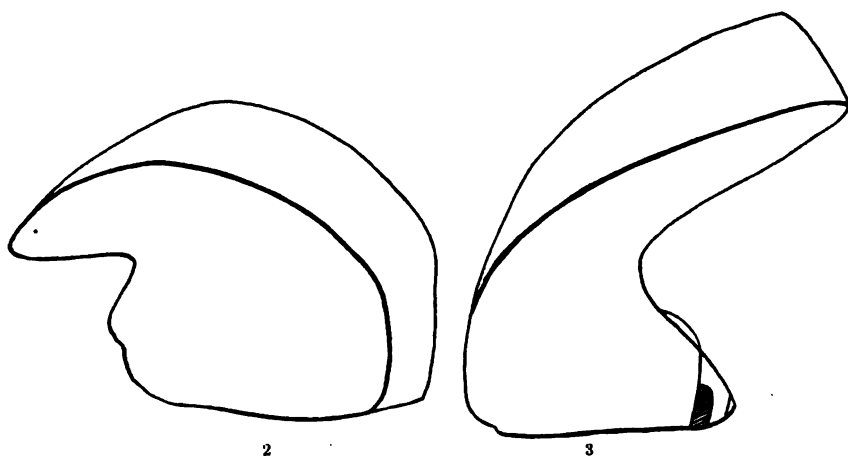
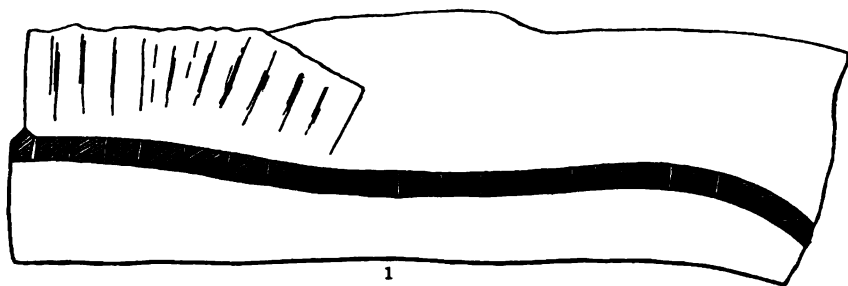
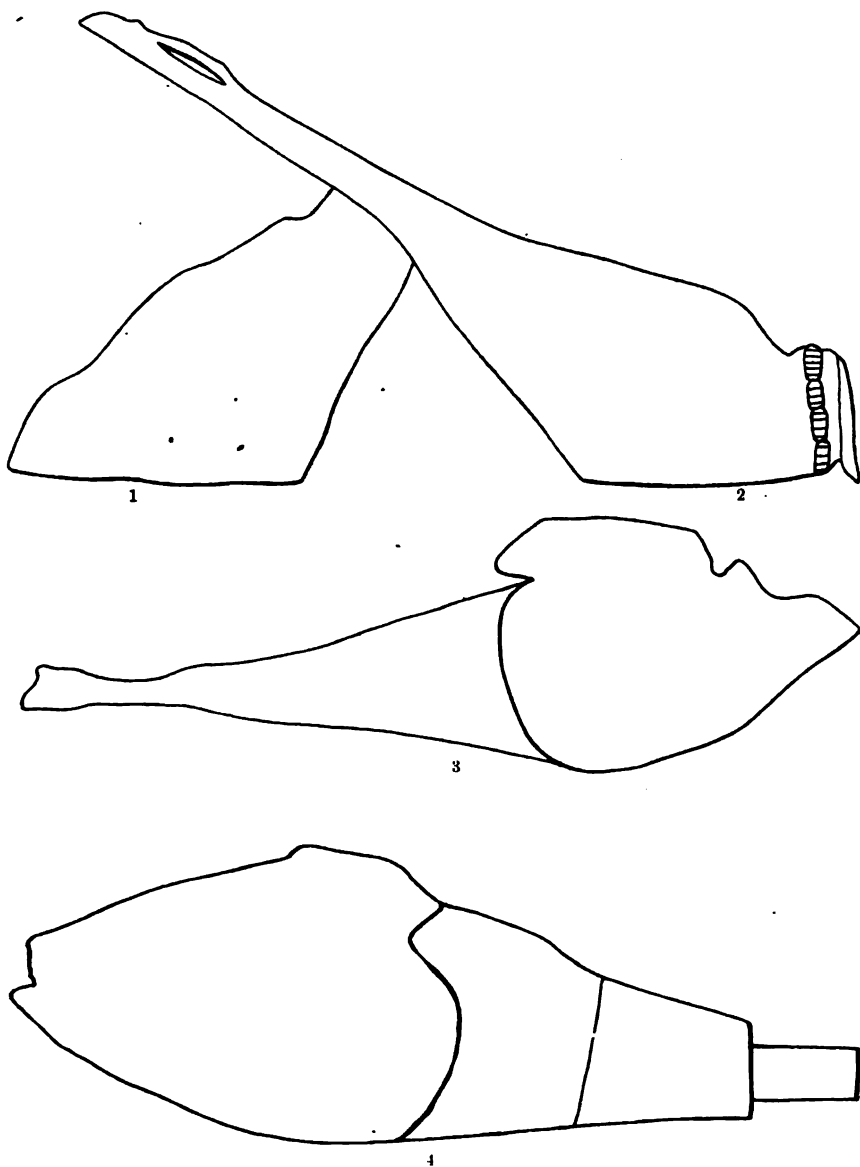


FIG. 1.—LOIN AND RACK. FIG. 2.—LOIN CHOPS. FIG. 3.—RIB CHOPS.



FIGS. 1 AND 4.—LEG, TRIMMED. FIGS. 2 AND 3.—LEG, UNTRIMMED.

[Continued from 2d page of cover.]

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[Continued on 3d page of cover.]

U. S. DEPARTMENT OF AGRICULTURE,

BUREAU OF ANIMAL INDUSTRY—Bulletin No. 62.

D. E. SALMON, D. V. M., Chief of Bureau.

THE
RELATION OF BACTERIA TO THE FLAVORS
OF CHEDDAR CHEESE.

BY

LORE A. ROGERS,

Expert in Dairy Bacteriology, Bureau of Animal Industry.



WASHINGTON:

GOVERNMENT PRINTING OFFICE,

1904.

LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF ANIMAL INDUSTRY,
Washington, D. C., July 1, 1904.

SIR: I have the honor to transmit herewith a paper on "The relation of bacteria to the flavors of Cheddar cheese," being a report of the investigations made by Mr. Lore A. Rogers, expert in dairy bacteriology in this Bureau. The general plan and scope of this work was determined by the chief of the Dairy Division, and the experimental portion was conducted under the supervision of the chief of the Biochemic Division. I recommend that this paper be published as a bulletin of this Bureau.

Respectfully,

D. E. SALMON,
Chief of Bureau.

Hon. JAMES WILSON,
Secretary of Agriculture.

Dy.—54.

CONTENTS.

	Page.
Introduction	7
Physical changes	8
Chemical changes	9
Causes of these changes	11
Lactic-acid bacteria	11
Pepsin	11
Galactase	12
The direct action of bacteria	15
Bacterial flora of Cheddar cheese	17
Cheeses I and II	17
Discussion of Tables V and VI	20
Cheeses IV and V	21
Discussion of Tables VIII and IX	23
Cheeses VII and VIII	24
Discussion of Table XI	25
The effect of temperature on the flora of cheese	26
Bacterial enzymes	28
Source of bacterial enzymes in cheese	32
Summary	35
Bibliography	37

ILLUSTRATION.

FIG. 1. Diagram showing lack of relation between bacteria and increase of amides and ammonia	27
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THE RELATION OF BACTERIA TO THE FLAVORS OF CHEDDAR CHEESE.

By LORE A. ROGERS,

Expert in Dairy Bacteriology, Bureau of Animal Industry.

INTRODUCTION.

Although cheese making has been carried on for many centuries, it is only in recent years that satisfactory scientific explanations have been offered for methods in use for ages. The impetus given by the work of Pasteur to biological research in general, and particularly to the study of fermentations, led naturally to investigations into the causes of cheese ripening. The first and most plausible explanation, that this change was brought about by bacteria and other micro-organisms, obtained such wide acceptance that it is still considered the correct one by all except those familiar with the most recent work. As this question came to be more carefully studied it was found that this theory was insufficient, for certain kinds of cheese at least, and that the complex changes taking place in the milk solids between the time the cheese is started in the vat and its sale as a food can be brought about only by a combination of causes. Our knowledge of these causes and the conditions governing them has been greatly advanced in the last few years by the work done in this country at the agricultural experiment stations in Wisconsin and New York (Geneva), and by Freudenreich and Jensen in Switzerland. While this work has gone a long way in clearing up the more obscure points, there is still much to be explained, and any data that will add to our somewhat limited stock of information will hasten the time when cheese making will be conducted entirely on scientific principles rather than by rule of thumb.

In this country we are especially interested at present in the ripening of Cheddar cheese, or, as it is more commonly called, American factory cheese, as this is the only kind made here on an extended scale. This kind of cheese is differentiated by its low water content from the soft cheeses of the Limburger and Brie type. The high water content of the soft cheeses, by making them a favorable medium for the growth of many kinds of organisms, changes the nature and rapidity of the fermentation. The American Cheddar resembles, in its method of manufacture, composition, and fermentations, the English Cheddar and the European Emmenthaler, or Schweizer.

The study of these fermentations is exceedingly complex, involving not only a great variety of biological questions, but also extensive

changes of the most obscure nature in the proteid compounds which make up the great bulk of the cheese curd. The most important of the final products of this digestion is, as we shall see later, a group of compounds known as amides.^a Some of these have their own peculiar, penetrating odor and taste. Many of them are, as their names indicate, found in decaying organic matter, but certain of the amides which give putrefying material its characteristic odor are not found in cheese. Thus the ripening of cheese, while resembling in many ways, especially in the highly flavored cheese of the Limburger type, the ordinary putrefaction of proteid matter, is distinguished from it by certain of the end products, as well as by the quantities in which the amides and ammonia are formed.

Before going into a discussion of the experimental work it will be well to mention briefly the changes taking place in ripening cheese, and to review our present knowledge of the causes which produce these changes. By the ripening we do not mean simply the development of certain desirable flavors. While these are essential, they are only the final result of a long series of complex changes which must take place before the tough, indigestible curd becomes edible; all of these changes are a part of the ripening and must be understood before we can hope to explain or control the production of flavors. In studying the ripening of cheese we have to do with one group of compounds only. The sugar, while it is rapidly broken up and may under certain circumstances be connected with certain abnormal fermentations, breaks down most rapidly into comparatively simple acids which have little direct influence on the flavor. On the other hand, many of the decomposition products of fat (which is an important constituent of Cheddar cheese) have an especially pungent odor and taste. However, it is well established that the change in the fat is, at most, very slight (Weidmann).^{1b} It is in the nitrogenous constituents—the casein, or, more properly, the paracasein—that we find the important changes.

In carrying on the work recorded in this paper the writer has received many valuable suggestions from Mr. Edwin B. Hart, associate chemist at the New York Agricultural Experiment Station. In the manufacture and initial bacteriological examinations of Cheeses IV and V, the bacteriological laboratory and the dairy of the New York Agricultural Experiment Station at Geneva were used. The many courtesies in this connection are acknowledged.

PHYSICAL CHANGES.

The changes in the physical condition of the curd are marked. The cheese as it comes from the press has the spongy consistency of a mass

^a In this paper, under the term amide, are included all nitrogenous compounds not precipitated by tannic or phosphotungstic acid, except ammonia.

^b See bibliography at end of bulletin.

of rubber, but may be broken into rough bits. During the ripening it becomes soft and waxy, until in a well-ripened cheese it may be spread with a knife like good butter. A thin rind is formed on the surface by the drying out of the curd and by the growth of molds and other organisms. This is always very thin and has no influence on the texture or flavor beyond a few millimeters from the surface.

CHEMICAL CHANGES.

The chemical changes in the nitrogenous constituents of the cheese are profound and affect very deeply its general appearance, its digestibility, and its flavor and aroma. In the milk nearly all of the nitrogen is in the form of casein floating in the serum as a fine suspension, which is coagulated by rennet, forming paracasein and thus greatly concentrating the proteids by separating from them a large part of the water. It has always been assumed that in the ripening process this substance was broken down directly into simpler bodies soluble in water. In a recent paper embodying the results of careful and exhaustive research, Van Slyke and Hart² show that there is formed in the early stages of the manufacture a monolactic acid salt of the paracasein. During the "ripening" of the milk and the heating of the curd after cutting, the milk sugar is split up into lactic acid by the acid-forming bacteria normally present in the milk or introduced as a starter, and the acid thus set free unites with the paracasein forming the unsaturated or mono-acid salt, if the acidity is normal; or a saturated or di-acid salt, if the acidity is abnormally high. This body is insoluble in water but soluble in dilute solutions of sodium chloride. In normal cheese it is present in quantities varying from 40 to 75 per cent of the total nitrogenous constituents. It has not been conclusively proved that the formation of lower compounds is at the expense of this body, but its gradual decrease and the proportional increase of water-soluble substances, during the ripening, point strongly to this assumption. This point is well illustrated in Table I, taken from Van Slyke and Hart's paper.

TABLE I.—Amounts of salt-soluble and water-soluble products in a cheese at different ages.

[From Am. Chem. Jour. XXVIII, 1902, p. 417.]

Age of cheese.	Per cent nitrogen of total nitrogen in cheese.	
	Nitrogen in form of compounds soluble in salt solution.	Nitrogen in form of water-soluble compounds.
1 day.....	58.7	6.78
1 month.....	42.4	19.30
3 months.....	33.4	26.02

As the ripening proceeds there is a gradual transition of the nitrogen from the more complex to simpler compounds. A number of bodies intermediate between the higher and lower proteids are formed, but only in small quantities. Albumoses and peptones are always present in considerable quantities, but in a normal cheese the nitrogen shows no tendency to accumulate in this form; the decomposition keeps pace with the production, resulting in an accumulation of amides, and to a less extent of ammonia. In a thoroughly ripened Cheddar cheese 3 or 4 per cent of the total nitrogen will be in the form of albumoses, and an equal amount in the form of peptones, while the amides will contain about 30 per cent of the nitrogen and the ammonia 3 to 5 per cent. As will be pointed out later, the rapidity of these changes depends directly, conditions of manufacture being equal, on the ripening temperature. While little experimental work bearing directly on this question has been done, the tendency is to believe that the flavor of cheese is due to the presence of the amido compounds, probably influenced to some extent by the ammonia. The gradual development of the flavors peculiar to Cheddar cheese appears to be closely associated with the accumulation of amides and ammonia, and probably has no direct connection with the presence of any of the other compounds in the cheese. On the contrary, the amounts of the more complex nitrogenous compounds are always smaller after the flavors have developed.

It is now well known that the intensity of the flavor may be more or less controlled by regulation of the temperature of the curing chamber. As a general rule the higher temperatures produce a more pronounced flavor. Chemical analyses of cheese cured at different temperatures show that the influence of a higher ripening temperature is most noticeable in the larger proportion of amides and ammonia to total soluble nitrogen. The sharpness that always occurs in cheese ripened at high temperatures is probably due, to some extent, to their high ammonia content^{3, p. 216}. On the other hand, cheese ripened at low temperatures has a clean but mild flavor and a correspondingly low amount of ammonia. In a valuable contribution to the study of cheese flavors, Van Slyke and Hart³ have shown the probability of certain changes among the amido bodies themselves that may account for at least a part of the changes that the flavor undergoes as the cheese ripens. They found in an examination of cheeses at different ages, differences in the kinds of amido bodies present that probably represented a transition from one class of compounds to another. In a cheese four and one-half months old they found lysatine, histidine, and lysine; in one fifteen months old, tetramethylenediamine (putrescine) and lysine. In discussing the results of their work they say:

There appears to be good evidence that there is regularly in the cheese-ripening process, in the case of hard cheeses like Emmenthaler and American Cheddar, a

conversion of primary into secondary amido compounds; and these chemical changes may explain, perhaps, the gradual development of flavor in normal cheese; in other words, we may find that the changing flavor of cheese, as it ages, is due, to some extent, to increasing quantities of secondary amido compounds.

To summarize: The chemical changes in ripening cheese consist essentially in the formation of a lactate of paracasein with a subsequent conversion into simpler compounds soluble in water, with a gradual accumulation of amides and ammonia. Certain of the amides themselves are probably still further broken up into simpler amides and into ammonia.

CAUSES OF THESE CHANGES.

LACTIC-ACID BACTERIA.

What is probably the first step in the breaking down of the soluble curd is brought about indirectly by the activity of bacteria. As has already been mentioned, the formation of compounds soluble in water is preceded by the union of lactic acid with the casein or paracasein, the acid having been produced through the fermentation of lactose by the lactic-acid bacteria. These are normally present in milk in large numbers, but their action is usually hastened by the addition of a "starter," which is practically a nearly pure milk culture of one or more species of the lactic-acid-producing bacteria. During the process of manufacture these bacteria attain to enormous numbers and in a short time cause a marked increase in the acidity. The proper degree of acidity is estimated roughly by cheese makers by touching a small piece of curd to a hot iron and observing the fine threads that appear as the curd is pulled away from the iron, the length of the string increasing with the acidity. Van Slyke and Hart have shown this property to be due to the presence of the lactate of paracasein. The action of the bacteria in this connection is entirely indirect, and cheese could doubtless be made without bacterial fermentation of the sugar by carefully adding small quantities of acid. Van Slyke, Harding, and Hart,⁴ in making cheese in which the bacteria were suppressed from the beginning by the addition of chloroform, produced the acid salt of paracasein by the gradual addition of lactic acid.

PEPSIN.

It has been shown by Babcock and Russell⁵ that pepsin is present in rennet extract, and is incorporated in the cheese in quantities sufficient to affect the ripening changes very appreciably. This was also proved, independently, by Orla Jensen⁶ working with Emmenthaler cheese. The former scientists give the results of extensive investigations, showing that the products resulting from the use of pepsin or an increased amount of rennet are the higher proteids characteristic of pepsin digestion.

TABLE II.—*Showing amounts of different nitrogenous decomposition products in cheese 6 months old, made with varying quantities of rennet.*

[From Seventeenth Annual Report, Wisconsin Agricultural Experiment Station.]

Amount of rennet per 1,000 pounds milk (ounces).	Per cent nitrogen of cheese in form of—				
	Total soluble.	Albumoses.	Peptones precipitated by—		Amides.
			Tannin.	Phosphotungstic acid.	
3.....	1.36	0.20	0.21	0.08	0.70
9.....	1.60	.42	.25	.08	.69
18.....	1.88	.68	.27	.07	.70

It will be seen from this table that an increased amount of rennet—that is, an increase of pepsin—resulted in an increase of soluble nitrogen confined to albumoses and higher peptones, while the lower peptones precipitated by phosphotungstic acid, the amides and the ammonia remained practically unchanged. While pepsin doubtless has more or less to do with the breaking down of the paracasein, it is quite evident that it can have only an indirect influence on the flavor, because its activity is confined entirely to the production of the higher products which play little or no part in giving the cheese its peculiar taste and aroma.

GALACTASE.

A distinct advance in the knowledge of cheese ripening was the discovery by Babcock and Russell ⁷ of a proteolytic enzyme inherent in milk, to which they gave the name galactase. This is secreted with the milk, and, becoming incorporated in the cheese, plays an active part in the general decomposition of the casein. In describing this enzyme Babcock and Russell ⁷, p. 179 compared it to trypsin, on account of the end products of its digestion and its accelerated action in an alkaline medium, but in a later report they ⁸ stated that it is differentiated from trypsin and related to the bacterial enzymes by its ability to form ammonia.

It has been pointed out by Freudenreich ⁹ that the increase of amido nitrogen in galactase digestion is unimportant, and his conclusions have recently been confirmed by the work of Van Slyke, Harding, and Hart ⁴, p. 244. The latter compared the progressive decomposition of normal cheese with that of cheese made to simulate as closely as possible the normal Cheddar, but in which the activity of all factors except pepsin and galactase had been excluded by the use of chloroform. It had been previously shown that the proteolytic action of galactase was only slightly if at all depressed by the presence of chloroform, even in large quantities. The results of their work bearing on this question are summarized in Table III.

TABLE III.—*Showing the progressive decomposition of normal cheese and of cheese ripened by pepsin and galactase only.*

[Adapted from Bulletin 208, New York Agricultural Experiment Station.]

Age of cheese (months).	Per cent nitrogen of total nitrogen in form of—					
	Albumoses and peptones.		Amides.		Ammonia.	
	Normal.	Chloroform.	Normal.	Chloroform.	Normal.	Chloroform.
1	2.95	3.71	5.42	0.86	0.86	0.00
1½	2.51	7.31	8.49	1.82	1.29	.00
3½	5.37	10.20	12.60	3.22	2.51	.00
5½	4.97	12.40	18.50	4.73	3.38	.00
7	3.08	10.90	20.10	8.11	4.42	.00
9	2.70	12.52	23.50	11.60	4.87	.00

An examination of this table shows a striking difference in the amounts of amido nitrogen in the normal and in the chloroform cheeses. At the end of three and one-half months the normal cheese contained nearly four times as much amido nitrogen as the chloroform cheese. This proportion was gradually reduced by the slow accumulation of amides in the chloroform cheese, but at nine months, when the normal cheese was thoroughly ripe, there was still twice as much amido nitrogen in the normal as in the chloroform cheese. On the other hand, the chloroform cheese contained, at nine months, nearly five times as much nitrogen in the more complex forms of albumoses and peptones as the normal cheese. Even more noticeable is the entire absence of ammonia in the chloroform cheese, forming a marked contrast to the normal, which at the end of nine months had nearly 5 per cent of its nitrogen in the form of ammonia.

The inability of galactase to form ammonia is even more distinctly shown by the digestion of casein in milk, cited in the bulletin referred to ⁴ p. 225. In this case the enzyme was working under very favorable conditions, yet while the amount of amides was comparatively high, ammonia was not formed. From these results it is safe to conclude that, while galactase may and probably does play an important part in the conversion of paracasein, or more probably paracasein lactate, into soluble compounds, these compounds are confined to the higher proteids—the albumoses and peptones—with only a slight formation of amides and none of ammonia.

This forces upon us the necessity of accounting for certain changes in normal cheese that can not be produced by the activity of galactase and pepsin alone. In other words, the presence of those compounds, the amides and ammonia, which probably give cheese its peculiar flavor, is due, partially at least, to the activity of a third factor which has not yet been definitely determined. The accelerating effect of high ripening temperatures on the rate and amount of change, and especially on the amounts and nature of the lower compounds, has already been

noted. The increased production of these simpler bodies may be due (1) to the accelerating effect of more favorable temperature on the enzymes present in the cheese; (2) to an increase in the numbers of bacteria normally present; or (3) to a change in the nature of the bacterial flora. The improbability that this increase in simple digestion products is brought about by the increased activity of galactase is illustrated by the comparison of the products of galactase digestion with ripe cheese given on page 165 of the Sixteenth Annual Report of the Wisconsin Experiment Station. In this case, although the enzyme was working in milk under most favorable temperature conditions ($37-38^{\circ}\text{C.}$), yet in 112 days it had converted only about 17 per cent of the total nitrogen into the form of amides, while in normal cheese, where the conditions would be much less favorable to enzymic activity, at approximately the same age, over 16 per cent was in this form. The entire absence of ammonia formation, even under most favorable circumstances, as noted above, makes this possibility even more remote.

The fact that the production of these compounds is suppressed by the presence of anesthetics, as has already been shown, and to some extent at least by low temperatures, would indicate that their presence was the result of vital activity. The causal relation between bacteria and the ripening of cheese, both in regard to the solution of the paracasein and the production of flavor, has long been maintained by different investigators. This could be brought about by bacteria, either directly through the metabolism of the living cells or indirectly through the action of enzymes secreted by them. In the latter case the action would be continued after the bacteria had entirely disappeared. Even with bacteria present in large numbers it is difficult to explain by the direct action of cells the extensive proteid decomposition that takes place in cheese. The amount of nitrogenous matter actually needed by bacteria for food is exceedingly small and a decomposition becomes marked only when, through the action of an excreted enzyme, the proteid is broken down in quantities greatly in excess of the needs of the organism. It is likely that the insoluble curd could be extensively changed by bacteria only through the agency of such an enzyme; and the probability of the conversion by intracellular action of the soluble bodies already formed by galactase and pepsin into the lower amides and ammonia in the quantities usually found in cheese seems remote.

In studying the relation between bacteria and the ripening of cheese, it is not sufficient, as some investigators have seemed to think, to isolate bacteria from cheese and test their ability to produce, when grown in pure culture in milk, cheese-like flavors and aromas. As Freudenreich has pointed out, cheese ripening is essentially a decomposition and the flavor is due to certain simple decomposition products not peculiar to cheese but belonging to proteids in general; these

bodies may be formed under favorable conditions by many species of putrefactive bacteria. The conditions existing in milk, and especially in milk containing a pure culture, are entirely unlike those existing in hard cheese, and results obtained in this way can not be logically applied to the whole problem of cheese ripening. To prove that any particular group or species of bacteria is the cause of cheese ripening or of any specific phase of it, it is necessary to show not only that these bacteria are present in the cheese, but that at the time these changes occur they are present in numbers sufficiently large to account for the phenomena, and that they are able, under similar conditions, to produce similar changes; if the bacteria have been present at an earlier stage, but have disappeared before the changes in question occur, it must be demonstrated that they secrete an enzyme capable of producing these results. With the complex conditions existing in cheese it is not easily possible to observe all of these rules with anything approaching exactness, but with our present knowledge of cheese ripening it is possible, by artificial fermentations, to secure results from which we may safely draw conclusions applicable to cheese-ripening problems.

THE DIRECT ACTION OF BACTERIA.

Sufficient work has already been done on the bacteria in various kinds of cheese to throw considerable light on this part of the problem. In Europe, especially, a great deal has been written on the relation of bacteria to cheese ripening. Most of the European bacteriologists have followed Duclaux in ascribing the essential rôle to bacteria of the liquefying class. Duclaux's¹⁰ conclusions were based on the ability of certain bacteria, which he called the "Tyrothrix," to digest milk so as to produce cheese-like flavors. Freudenreich has shown repeatedly that while the lactic bacteria develop rapidly in Emmenthaler cheese and soon attain enormous numbers, the liquefying bacteria of the Tyrothrix, or hay bacillus group, find in hard cheese unfavorable conditions and never multiply even when artificially introduced in large numbers. The lactic-acid bacteria increase rapidly for a short time, and a slow decrease follows. Old Emmenthaler, even when showing signs of putrefaction, contains a comparatively small number of bacteria.¹¹

The only exhaustive quantitative bacteriological study on American Cheddar cheese is that of Russell and Weinzirl.¹² They found a slight decrease in the total number of bacteria in the first day or two after making, followed by a rapid increase. The maximum was reached in 4 to 24 days, depending apparently on the temperature at which the cheese was kept, and then began a decline, rapid at first, but soon becoming more gradual and continuing as long as the cheese was examined. The increase was confined to the lactic-acid bacteria

with sometimes a slight increase in the gas formers. The digesting bacteria did not increase, but, on the contrary, soon almost completely disappeared.

Work done by Harrison,¹³ partly at the Wisconsin Station and partly in Canada, shows that these results are correct for American Cheddar in general; by studying the bacterial flora of three Canadian cheeses for an extended period, he obtained results confirming, with a few minor exceptions, the conclusions of Russell and Weinzirl. On the basis of these results, together with those of Freudenreich, which are doubtless applicable to all hard cheese, the only bacteria capable of directly influencing cheese ripening are those of the lactic-acid-forming group. This necessarily assumes for this group the ability to effect extensive changes in the cheese proteids. It has been maintained by Freudenreich that the lactic-acid bacteria, or at least certain varieties which he finds predominating in Emmenthaler cheese, possess this ability. By growing them in sterile milk, in which their action was prolonged by neutralizing the acid formed with calcium carbonate, he found a decided increase in the amount of soluble nitrogen, of which a large part was in the amido form.¹⁴ This work has not been confirmed. In repeating these experiments Nicholson,¹⁵ working at the University of Wisconsin with lactic-acid bacteria from cheese, was unable to detect any appreciable increase of soluble nitrogen in milk cultures in which the acid had been neutralized with sodium carbonate.

It has also been suggested that the digestion of milk casein was not comparable to the digestion of paracasein. Chodat and Hofman-Bang¹⁶ tested the digestive ability of lactic-acid bacteria by growing them in a medium made by coagulating milk with rennet, washing until Fehling's solution failed to give a test for sugar, drying and using about 1½ grams with a suitable amount of water. By removing the sugar the inhibitory effect of the acid was avoided and the bacteria were allowed to grow unchecked for 81 days. At the end of this time there was no appreciable increase in soluble nitrogen. This work is, however, open to criticism in that the removal of the sugar prevented the formation of the first decomposition product and possibly the further digestion of the paracasein.

Freudenreich's¹⁷ hypothesis of the relation of lactic-acid bacteria to the ripening of Emmenthaler cheese is based largely on his experiments in which cheese made from heated milk, or from milk in which the bacteria had been largely excluded by aseptic conditions, ripened normally only when lactic-acid bacteria developed. While Van Slyke and Hart do not maintain that the acid salt is an essential step in the digestion of casein by enzymes other than pepsin, they do show that it is digested in normal cheese ripening. It is probable that this is a necessary step in the breaking down of the curd and it is possible that Freudenreich's cheese failed to ripen, not because the direct action of

the lactic bacteria was wanting, but because of the absence of the lactate of paracasein formed indirectly by this group of bacteria.

In the paper mentioned above, Freudenreich admits the probable action of galactase, and probably a liquefying coccus, in the digestion of the curd; but still maintains that the production of the lower by-products, and consequently the flavor, is due to the action of the lactic bacteria. If, as Freudenreich evidently assumes, the lactic bacteria change peptones and other soluble proteids into amides and ammonia without the agency of an enzyme, cheese held at a comparatively high temperature, where the ripening is more active, should show a larger number of lactic bacteria than cheese made under identical conditions but held at a temperature low enough materially to check the ripening. If other bacteria play a direct part in forming amides and ammonia there should be a differentiation, qualitative or quantitative, in the bacterial flora of the two cheeses. Babcock and Russell,¹⁸ in a paper on the effect of differences in temperature on the ripening of Cheddar cheese, discuss the comparative flora of high and low temperature cheeses, without, however, going into details. In both cheeses the lactic-acid bacteria were soon predominant. The development was slower in the cheese cured at low temperatures but persisted for a longer time, while in the high-temperature cheese the numbers were greatly diminished and persisted for a shorter time. They also state that there was a qualitative differentiation and suggest that this has possibly a relation to the change in flavor.^a

BACTERIAL FLORA OF CHEDDAR CHEESE.

CHEESES I AND II.

The work which has already been done on the bacteria of cheese leaves little question as to the general nature of the flora of hard cheese. It has seemed advisable, however, to go over a part of the ground again in connection with a general investigation of the changes and flavors of cheese. Certain phases of the subject have been selected for review and especially the effect of temperature on the flora and its possible connection with the flavor. As the material for beginning this preliminary investigation, two cheeses were obtained from Cook Brothers, of Lewis County, N. Y., made in their factory under commercial conditions from purchased milk. They represented normal American factory cheese in every way, except being of the Young America size, and consequently liable to become abnormally dry. This was prevented by giving them a heavy coating of paraffin soon after they were received. The two cheeses were made together and

^a Since this paper was written, the results of an extensive investigation on this question have been published by Harrison and Connell.¹⁹ These confirm, in a general way, the results given in this paper.

separated only at the press. They were shipped on the third day after making and were 7 days old when received at the laboratory.

Cheese I was placed in a refrigerator at a temperature of 10° to 12° C., where it remained for about one month, when it was changed to a specially constructed curing box, in which the temperature varied from 5° to 10° C. Cheese II remained at room temperature (20° to 25° C.) for 1 month, when it was transferred to a curing box so constructed that it could be held at a constant temperature of 23° C. Cheese II ripened rapidly. When only 36 days old it was already well ripened; at 50 days it still had a mild flavor, but at 80 days the flavor was sharp. It deteriorated very rapidly after reaching its prime until at 123 days it was so strong, both in flavor and odor, as to be unfit to eat. On the other hand Cheese I ripened very slowly. At 81 days it still had a distinctly unripe taste, but when 123 days old it had developed a very fine mild flavor.

The difference in the composition of the two cheeses, when matured, is given in the following table:

TABLE IV.—*Per cent nitrogen of cheese in Cheeses I and II when 123 days old.*^a

In the form of—	Cheese I.	Cheese II.
Total soluble	0.85	2.00
Albumoses and peptones	.85	.38
Amides	.42	1.38
Ammonia	.08	.24

^a In making the chemical analyses given in this paper the methods given by Van Slyke and Hart²⁰ were followed. The amides and ammonia were determined in the filtrate from tannic-acid sodium chloride precipitate, and the albumose and pepton nitrogen was obtained by difference. The latter thus includes all proteids precipitated by tannic acid.

The essential difference is found in the high amide and ammonia content of the highly flavored cheese, compounds which, as has already been pointed out, are characteristic of bacterial digestions rather than of digestion by pepsin or galactase.

The bacterial flora of these cheeses was studied from the time they were received until they were completely ripe, not, however, with any attempt to separate and describe the various species present. While this would be desirable, it is doubtful if the value of work of this nature, especially when the present condition of systematic bacteriology is considered, is sufficient to repay the great labor involved. The object of this part of the investigation was to determine if differences in temperature resulted in a differentiation, qualitative or quantitative, in the bacterial flora and, if any differentiation occurred, whether or not it bore any relation to the differences in flavor. For this purpose it was enough to determine the total number of bacteria and to separate them in a general way into groups.

In the bacteriological examination of cheese certain peculiar difficulties are encountered that render the most carefully obtained results

more or less inaccurate. Slight variations in the texture or the mechanical arrangement of the curd at the time of pressing cause an unequal distribution of the bacteria, and this difference is intensified by the relatively small sample that can be used. An even more serious difficulty is the extremely large dilutions that must be used, especially when the cheese is still young and the number of lactic-acid bacteria is large. If one uses a dilution large enough to allow a count of the lactic colonies, there will be at most only an occasional colony of the less numerous forms and an accurate count can not be made. On the other hand, if a small dilution be used the lactic colonies will be so numerous as to inhibit the growth of all species less resistant to acid. However, exact numerical results are not essential. It is sufficient if we know what species occur and approximately the numbers present.

The results of the bacteriological examinations of Cheese I and Cheese II are given in Tables V and VI. The ordinary method was employed of grinding a weighed sample of the cheese with sterile sugar and diluting with water. For the lactic-acid bacteria, lactose gelatin was used with the addition of sterile litmus solution, and for the nonlactic forms the ordinary beef extract pepton gelatin. The yeasts were determined by adding to each tube of gelatin sufficient tartaric acid to inhibit completely the growth of bacteria.

TABLE V.—*Bacteria and yeasts per gram in Cheese I, ripened at 5° to 10° C.*

Age (days).	Total bacteria and yeasts.	Lactic-acid bacteria.	Yeasts.	Liquefying bacteria.
7	84, 770, 000	84, 570, 000	200, 000	.....
16	22, 199, 000	21, 970, 000	229, 000	.....
22	4, 471, 000	4, 445, 000	18, 000	8, 000
36	4, 210, 700	4, 164, 000	46, 000	700
50	2, 772, 500	2, 717, 000	55, 700	800
60 ^a .....	.....	.....	.....	4, 200
81	453, 800	438, 000	11, 600	6, 100
128	3, 913, 650	3, 904, 000	7, 050	2, 600
382	50, 200	45, 600	.....	4, 600

^a Alkaline gelatin.

TABLE VI.—*Bacteria and yeasts in Cheese II, ripened at 20° to 25° C.*

Age (days).	Total bacteria and yeasts.	Lactic-acid bacteria.	Yeasts.	Liquefying bacteria.
7	66, 676, 000	66, 360, 000	316, 000	.....
16	3, 147, 000	3, 143, 000	4, 000	.....
22	546, 000	538, 000	5, 550	2, 500
36	167, 000	164, 000	200	2, 900
50	289, 900	289, 000	.....	900
60 ^a .....	.....	.....	.....	1, 600
81	10, 800	9, 200	.....	1, 600
128	42, 500	42, 000	.....	500

^a Alkaline gelatin.

The results given in Tables V and VI, agree in a general way with those of Russell and Weinzirl, and Harrison. The flora proved to be made up almost entirely of lactic-acid-forming bacteria. Yeasts were present in considerable numbers, but decreased slowly in the low-temperature cheese and more rapidly in the one held at the high temperature.

The total bacteria.—The bacteria had reached their maximum at or before the time the first examination was made. In Cheese I the decrease was rather rapid for a short time and then very gradual up to 123 days. The recorded increase at that time was not actual, but was due to the presence on these plates of a large number of extremely small lactic colonies. The plates on this date were plain pepton gelatin without the addition of litmus, while in the earlier plates, made with considerable litmus, these colonies, on account of their small size and weak acid formation, were probably entirely overlooked. At this time they made up nearly the entire acid-forming flora. There were in both cheeses a comparatively small number of inert forms of various kinds, but as they were present in unimportant numbers no accurate count was made. A large number of subcultures were made from this group from time to time, but there was no particular predominating form and no differentiation in favor of either cheese.

In Cheese II the decrease was very rapid, the total falling in the second week from 66,000,000 to 3,000,000, and in the third week to about 500,000. It is probable that these numbers are somewhat low, as the small lactic colonies mentioned under Cheese I were present in considerable numbers at 123 days. These colonies were almost microscopic, and an accurate count could not be made. However, their number was estimated at 2,000,000 to 3,000,000 per gram. They were designated as the bb type. Subcultures were made from these colonies and the effect of this species on bouillon and on litmus milk was observed. In the bouillon the growth was at the bottom only. Milk was curdled very slowly, and the litmus changed to pink. There was no digestion.

The liquefying bacteria.—In the first two sets of plates made with the dilutions necessary for the large number of lactic bacteria, no liquefying colonies appeared. In the later examinations plain pepton gelatin plates were made with small dilutions, and liquefying bacteria were found in comparatively small numbers. It was found that the number of liquefiers could be more accurately determined by adding to each tube of 6 or 7 cubic centimeters of pepton gelatin 1 cubic centimeter of N/10 NaOH. This amount is sufficient to inhibit greatly most of the acid-forming species without materially retarding the liquefying forms. Counts obtained by such methods are necessarily inaccurate, as some of the liquefiers would probably be inhibited by a strongly alkaline medium. In these two cheeses, at least, the liquefying bac-

teria persisted in small but appreciable numbers for some time, and did not, as both Russell and Harrison have stated to be the case in hard cheese, almost completely disappear in a short time. These were not entirely, as might be expected, colonies of spore-forming bacteria of the hay bacillus type, but included, especially in the first few weeks, many colonies of a coccus forming a small saucer-shaped liquefaction, with a round white or straw-colored colony in the center. The total number of liquefiers decreased slowly in both cheeses and, like the other groups, more rapidly in Cheese II.

CHEESES IV AND V.

In continuance of the same line of investigation, a similar examination was made of two cheeses made under the personal supervision of the writer at the New York Agricultural Experiment Station on the 29th of January, 1903. The mixed milk of two days was used. Part of this was held overnight without cooling, in order that the bacteria might develop in a normal manner. At this time, on account of the recent loss of the station barns by fire, the herd was stalled in temporary sheds. Notwithstanding these unfavorable surroundings, the milk was in better than average condition, as the bacteriological examination shows. The milk was ripened by Hansen's dry lactic ferment, and the cheese was made by the usual Cheddar method. At the time of pressing the curd was separated into two equal parts and pressed as two Young Americas, each weighing about 9 pounds. On the following day they were taken from the press and shipped by express. They arrived in Washington twenty-four hours later, and were transferred at once to the curing boxes, Cheese IV, at 23° C., and Cheese V in the one held at 5–10° C. Gelatin plates were made from the milk before adding the starter and from each cheese after taking from the press and at short intervals up to 133 days.

For some unknown reason these cheeses ripened very slowly. In Cheese IV, when 77 days old, while the curd was apparently well broken down, there was very little flavor, and 20 days later, although some advancement was shown, it was still only slightly developed. Cheese V at 77 days still had the flavor of green cheese, although the texture showed considerable change. Twenty days later there was apparently a slight increase in flavor. The progress of the ripening is well illustrated by the chemical analysis made at 77 days and given in Table VII.

TABLE VII.—Per cent nitrogen in Cheese IV and Cheese V when 77 days old.

In the form of—	Cheese IV.	Cheese V.
Water-soluble.....	1.45	0.72
Albumoses and peptones.....	.99	.51
Amides.....	.38	.15
Ammonia.....	.08	.06

The relatively high amount of water-soluble nitrogen and the low amount of amides and ammonia agree with the condition of the texture and flavor at this time. The bacteria were determined as before by the use of lactose-litmus gelatin for the lactic group, and alkaline-pepton gelatin for the liquefiers. Only approximate results can be obtained for the latter group by this method on account of the frequent rapid growth of colonies of the hay bacillus type necessitating a count before the smaller colonies have developed.

TABLE VIII.—*Number of bacteria per gram in milk and in Cheese IV.*

Product and age (days).	Total bacteria.	Lactic group.		Liquefying group.			
		Total.	214 bb type.	Total.	Hay b type.	214 q type.	214 z type.
MILK (10 c. c.) a.	435,000	99,000	.....	315,000	6,000	309,000	.....
CHEESE:							
1.....	17,103,800	17,090,000	.....	13,800	1,800	12,000	.....
3.....	62,015,600	62,000,000	.....	15,600	4,800	8,400	2,400
7.....	29,148,000	29,118,000	.....	30,000	6,000	2,000	22,000
11.....	12,556,100	12,540,000	.....	16,100	3,600	.....	12,500
15.....	36,375,700	36,360,000	.....	15,700	6,600	.....	7,800
35.....	.....	49,800,000	5,600,000	Plates all liquefied.			
42.....	16,335,200	16,320,000	.....	12,800	.....	.....	.....
53.....	19,418,400	19,400,000	6,040,000	18,400	3,200	.....	15,200
65.....	12,888,200	12,880,000	3,949,000	8,200	.....	.....	.....
77.....	3,379,000	3,357,000	2,826,000	22,000	6,100	.....	15,900
95.....	1,130,000	1,122,000	794,000	18,000	10,400	.....	7,600
116.....	929,200	914,000	778,000	15,200	7,300	.....	7,900
133.....	866,700	856,000	275,000	10,700	4,900	.....	5,800

a Plates made immediately before adding rennet.

TABLE IX.—*Number of bacteria per gram in milk and in Cheese V.*

Product and age (days).	Total bacteria.	Lactic group.		Liquefying group.			
		Total.	214 bb type.	Total.	Hay b type.	214 q type.	214 z type.
MILK (10 c. c.)	435,000	99,000	.....	315,000	6,000	309,000	.....
CHEESE:							
1.....	25,905,600	25,860,000	.....	45,600	2,400	43,200	.....
3.....	56,625,500	56,600,000	.....	25,500	4,100	18,600	2,800
7.....	36,098,000	36,060,000	.....	38,000	8,000	.....	30,000
11.....	25,456,400	25,420,000	.....	36,400	10,000	2,400	24,000
15.....	51,454,000	51,440,000	.....	14,000	5,500	4,500	4,000
35.....	30,417,400	30,400,000	.....	17,400	3,000	600	5,400
42.....	54,793,500	54,774,000	.....	10,500	.....	.....	.....
53.....	55,884,200	55,880,000	3,380,000	4,200	.....	.....	.....
65.....	50,504,600	50,500,000	1,020,000	4,600	.....	.....	.....
77.....	56,555,000	56,538,000	14,194,000	17,000	3,800	.....	13,200
95.....	19,607,900	19,600,000	10,180,000	7,900	.....	.....	.....
116.....	19,104,800	19,100,000	4,950,000	4,800	2,600	.....	2,200
133.....	25,989,900	25,980,000	2,355,000	9,900	6,600	.....	3,300

DISCUSSION OF TABLES VIII AND IX.

In these cheeses the separation into groups was carried somewhat further than in Cheese I and Cheese II. Included in the lactic group is the bb type already mentioned as observed in the late stages of the ripening of Cheese I and Cheese II. In the liquefying group are included, in addition to the common hay bacillus, the type 214 q (a coccus forming small white or straw-colored colonies surrounded by a saucer-shaped liquefaction) and the 214 z type, a bacillus forming a very small cup-like liquefaction with a white film of growth over the surface; 214 q is probably identical with the coccus occurring in Cheese I and Cheese II. Each of the two latter types probably included more than one variety.

The total bacteria.—The striking feature of the flora was the long duration of the comparatively high numbers. The maximum number was reached in each cheese at or soon after the third day. This was followed in Cheese IV by a comparatively small drop to a number that was held for a long time. A second decided drop occurred at 77 days in Cheese IV, and at 95 days there was a distinct decrease in Cheese V. This change corresponds in a general way with the change in the flavor. In other words, the development of the flavor-producing compounds and the bacterial changes apparently remained at a standstill for several weeks.

The lactic group.—Since the total is made up almost entirely of lactic bacteria, what has been said of the total will apply also to the latter group. The numbers given for this group, as well as those of the totals, show more or less variation due largely to the erratic growth of the bb type, previously mentioned. Slight variations in the conditions sometimes entirely suppressed the formation of colonies of this type, which in connection with the difficulty of making an accurate count of colonies almost microscopic in size, will account for most of the variation in numbers. There was apparently no real, but rather only a relative, increase of the bb type in the high-temperature cheese. There was in these cheeses a decrease in this group, but it was much slower than that of the other varieties, and at 95 days it made up almost the entire lactic group.

The liquefying group.—Numbers given under this heading can be considered only as rough approximations, indicating in a general way the kinds of liquefiers present and their relative numbers. There was evident a distinct decrease in the total, confined largely to the 214 q type. This coccus decreased with some rapidity in the high-temperature cheese, practically disappearing at 7 days, while in the low-temperature cheese it persisted for about 30 days longer. There was an apparent increase in type 214 z, but this may have been because these colonies developed slowly and were overlooked on the first few sets

of plates. With these two exceptions this group maintained fairly constant numbers throughout the entire period.

CHEESES VII AND VIII.

A third pair of duplicate cheeses were made for this investigation under commercial conditions by Cook Brothers, of Lewis County, N. Y., and shipped in an ice chest on the second day after making. They were made the last of June and were 5 days old when received, but, as the chemical and bacteriological analyses show, were practically fresh. Cheese VII was stored in a large refrigerator. This held ordinarily at about 12° C., but during the hot weather it went a few times above 15° C. In the latter part of the ripening the temperature ranged between 8° and 12° C. Cheese VIII was held at a constant temperature of 23° C. Cheese VII ripened slowly and normally, showing at 90 days a fine, smooth texture and clean flavor, with only a slight sharpness. At 164 days, although overripe and somewhat sharp, it was still in fair condition. Cheese VIII, on the other hand, was well ripened when 37 days old. It had then a clean flavor with only a slight sharpness. At 93 days it had a strong odor and taste and was entirely unfit for use. Chemical analyses made from time to time to show the progress of the ripening are given in the following table:

TABLE X.—*Relative rate of ripening of Cheeses VII and VIII.*

Cheese number.	Ripening temperature.	Age.	Percent nitrogen of cheese in the form of—			
			Total soluble.	Albumoses and peptons.	Amides.	Ammonia.
	° C.	Days.				
VII	10-12	5	0.24	0.14	0.10	0.00
		37	.79	.42	.30	.07
		93	1.07	.61	.40	.06
		136	1.27	.68	.49	.10
VIII	23	5	.21	.15	.06	.00
		37	1.06	.45	.49	.11
		93	1.30	.57	.65	.08
		136	1.50	.56	.75	.19

Bacteriological analyses were made as before with lactose litmus gelatin for the determination of the lactic bacteria and with alkaline gelatin for liquefiers. The results are given in the following table:

TABLE XI.—*Number of bacteria in Cheeses VII and VIII.*

Age (days).	Total bacteria.	Lactic.		Liquefiers.	
		Total.	Small colonies.	Total.	214 q.
Cheese VII:					
5.....	157,950,000	156,640,000	.....	1,310,000	1,310,000
9.....	.....	114,160,000	.....	.....	.....
16.....	74,682,300	74,680,000	.....	2,700	2,300
23.....	41,620,600	41,620,000	3,600,000	600	600
30.....	76,901,200	76,900,000	5,120,000	1,200	800
37.....	40,140,600	40,140,600	.....	600	600
88.....	12,972,200	12,970,000	4,820,000	2,200	2,000
112.....	1,031,400	1,030,000	.....	1,400	1,400
134.....	637,800	637,000	.....	800	400
Cheese VIII:					
5.....	151,140,000	147,580,000	.....	3,560,000	3,560,000
9.....	90,950,000	90,150,000	.....	800,000	800,000
16.....	84,880,600	84,880,000	.....	600	600
23.....	24,792,000	24,790,000	6,560,000	2,000	1,200
30.....	11,840,000	11,840,000	1,860,000	.....	.....
37.....	5,621,200	5,620,000	1,520,000	1,200	800
88.....	961,400	961,000	310,000	400	.....
112.....	188,000	188,000	.....	.....	.....
134.....	12,000	12,000	.....	.....	.....

DISCUSSION OF TABLE XI.

The total bacteria.—In the low-temperature cheese the bacteria decreased slowly, nearly one-fourth of the initial number remaining at 37 days. In Cheese VIII the decrease was comparatively rapid, showing at 37 days only about one-thirtieth of the initial number. At 112 days there were present in Cheese VIII less than 200,000 per gram, while in Cheese VII, at the same age, there were still over 1,000,000. The total was made up, as usual, almost entirely by lactic-acid bacteria. The variety forming very small colonies was present and showed, as before, more ability to resist unfavorable conditions. Otherwise there was no differentiation apparent as the ripening proceeded.

The liquefying bacteria.—The plates made on the day these cheeses were received showed a considerable number of liquefying bacteria of the 214 q type already noted as occurring in each of the four cheeses previously examined. These high numbers dropped immediately, and, although liquefiers were present in both cheeses for some time, they were in small numbers only. Excepting this type, these cheeses were almost entirely free from ordinary liquefiers. The small numbers included under the total were occasional colonies, mostly of the hay-bacillus type.

In addition to these two types there was present, and included with the lactic bacteria, a species liquefying gelatin so slowly that it would ordinarily be entirely overlooked. On the alkaline gelatin plates the

colonies appeared as good-sized lactic colonies. When growing on or near the surface they became surrounded by a very slight depression noticeable only when seen from a sharp angle. On lactose-litmus gelatin plates they appeared only as large lactic colonies surrounded by a red zone. The liquefaction of gelatin seems to be partially inhibited by the presence of lactose. In stab cultures the gelatin is liquefied very slowly, the liquefaction beginning at the surface and extending downward along the line of inoculation. In the course of time the upper part of the gelatin becomes entirely liquefied. On account of the difficulty in distinguishing the colonies of this species from those of the ordinary lactic forms, no separate count was made, but in Cheese VII, when 112 days old, probably about 10 per cent of the total bacteria were of this type. A careful examination of Cheese I, made when it was about one year old, showed that this species was still present in small numbers.

THE EFFECT OF TEMPERATURE ON THE FLORA OF CHEESE.

The effect of the temperature on the flora, as indicated by the six cheeses examined, may be summarized as follows: An increase in the ripening temperature resulted in a rapid decrease in the number of bacteria of all kinds; in the cheeses cured at a low temperature the decrease was much slower, corresponding in a general way to the retarded ripening of the cheese. In other words, the decrease of the bacteria was directly proportional to the rate of ripening. Although a temperature of 23° C. is known to be much more favorable to the development of bacteria than a temperature of 10–12° C., there was in no case, and at no stage of the ripening, an increase in the number of bacteria in the cheeses at the higher temperature. We find also that the variation in the temperature conditions produced no differentiation in the kinds of bacteria present. At no time in the ripening of these cheeses could there be detected in one cheese a species which was not present in its duplicate. In the high-temperature cheeses, where the development of certain kinds of bacteria might be expected, the rapid decrease in numbers was not confined to the lactic bacteria, but included all other species. The only kinds not showing a rapid decrease in numbers were the spore-forming liquefiers. With the possible exceptions of Cheese IV and Cheese V, these were present in small numbers only, and while they did not decrease distinctly there was at least no increase.

These results do not confirm the commonly accepted theory that the undesirable flavor of high-temperature cheese is due to the development of abnormal bacteria. On the contrary, it is evident that, in these cases at least, the undesirable flavor was brought about through some other agency and in all probability by the accelerated action of enzymes which were present in the cheese when it was made or developed in the

earlier stages of the ripening. The more favorable temperature conditions caused a more active metabolism, which was responsible for, or at least was coincident with, the rapid decrease in the bacteria. It is also evident, both from the chemical analyses and from the development of flavor, that important changes were taking place after the bacteria had reached very low numbers. This is well illustrated by Cheese VIII. In the period between the ages of 93 and 136 days there was a decided increase in total soluble nitrogen, confined almost entirely, in so far as the analyses show, to ammonia. At this time there was present only an insignificant number of lactic-acid bacteria.

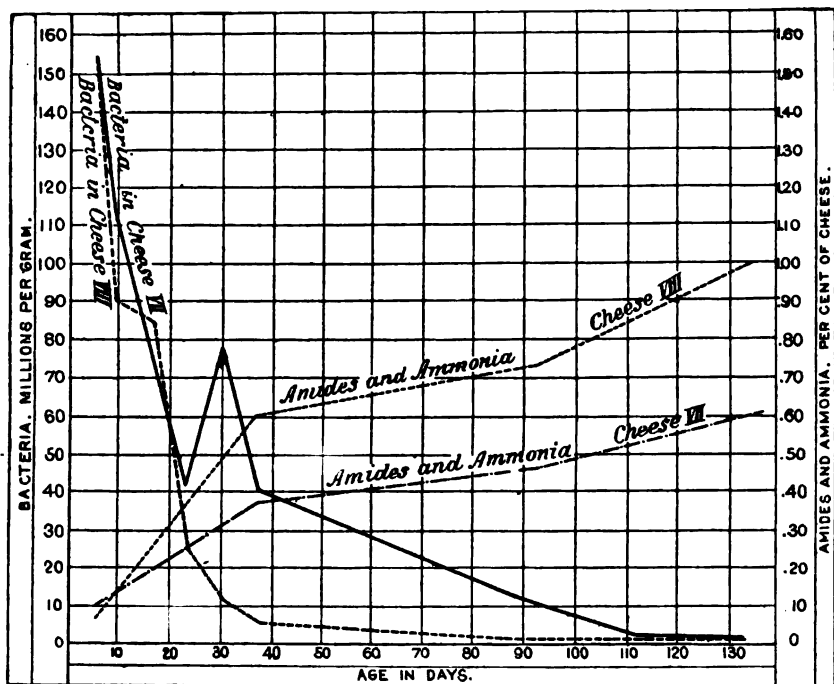


FIG. 1.—Diagram showing lack of relation between bacteria and increase of amides and ammonia.

It seems safe to conclude from these results that the bacteria have little or no direct action in the formation of flavor-producing compounds. In this regard this work confirms the views brought forward in a recent paper by Van Slyke and Hart²¹, in which they compare the carbon dioxide production of a normal cheese with one in which vital activity had been suppressed by the addition of chloroform. In the latter carbon dioxide was produced for a short time and then almost completely ceased, while in the normal cheese it was continued in considerable quantity for a long period of time. In the normal cheese the carbon dioxide production continued steadily for over 200 days and was apparently little influenced by the usual decrease in the

number of bacteria, although, as all work along this line has proved, the bacteria must have reached, in the latter part of this period, very low numbers. In the chloroformed cheese the amido bodies, while present in amounts nearly as great as those of the normal cheese, were confined largely to the primary amides and ammonia was not formed. On the other hand, in the normal cheese the amido bodies were still further broken down into the secondary compounds and into ammonia. They attribute the greater part of the carbon dioxide formation, after the early acid fermentation, to its liberation by the breaking up of the amido bodies, and conclude that this must be brought about by the action, direct or indirect, of bacteria, which are suppressed by the presence of chloroform. There could have been in the milk from which the chloroform cheese was made no enzyme able to form the simple decomposition products which these investigators have found to be characteristic of well-ripened cheese.

In view of the results of investigation reviewed and reported herein, it seems very improbable that the production of secondary amides and ammonia in normal cheese is due to the direct action of bacteria. A much more rational explanation is that there is secreted by bacteria, either in the milk before the cheese is made or in the cheese itself during the earlier stages of the ripening, proteolytic enzymes able to break up proteids into secondary amides and ammonia. The next step desirable, therefore, is to consider bacterial enzymes and their source when occurring in cheese.

BACTERIAL ENZYMES.

The secretion of soluble proteolytic enzymes is comparatively common among bacteria, and the causal relation of these enzymes to the ripening of cheese has often been suggested. Duclaux ¹⁶, who was one of the first to support the bacterial enzyme theory, based his opinion on the ability of his "Tyrothrix" bacteria to secrete an enzyme, the so-called casease, capable of digesting milk with the formation of cheese-like flavors and aromas. But this theory is supported by so little experimental evidence that it can be considered only as an hypothesis. Freudenreich, as has already been mentioned, has shown that these bacteria occur in normal Emmenthaler cheese in small numbers only and never increase, even when introduced in large numbers. Freudenreich ¹⁷, while maintaining the importance of lactic-acid bacteria in the ripening of hard cheese, has suggested the possibility that the enzyme of a certain liquefying coccus plays a part in the decomposition. Jensen ¹⁸, in a paper on enzymes in cheese, expresses the belief that certain lactic-acid bacteria isolated from Emmenthaler by Freudenreich are able to secrete a casein-digesting enzyme, but his efforts to demonstrate its existence gave only negative

results. In the same paper Jensen attempts to demonstrate that bacterial enzymes are developed in Emmenthaler as it ripens. While his conclusions are probably correct, his methods are open to criticism in that he has assumed that the presence of 0.1 per cent of formaldehyde excludes very largely the action of galactase without materially affecting the action of bacterial enzymes. Van Slyke, Harding, and Hart ^{4, p. 230}, have shown that the action of galactase is only partly inhibited by this amount of formaldehyde. Jensen's work indicates that there exist in ripe Emmenthaler enzymes which are able to increase the less complex decomposition products when the cheese is allowed to digest in the presence of formaldehyde. These enzymes seem to be absent in young cheese.

In studying the relation of bacterial enzymes to Cheddar cheese ripening, in the investigation here recorded, the writer has employed a somewhat similar method. At various stages of the ripening samples of 25 grams each were drawn from the cheese, trituated with quartz sand, 196 c. c. water, and 4 c. c. (2 per cent by volume) chloroform added, and the mixture held in sealed flasks in the high-temperature (23° C.) curing box. Chemical analysis made of duplicate samples gave the initial composition before the digestion. By eliminating in this way the action of the bacteria and allowing the enzymes to continue their digestion it was possible to obtain some indication of the nature and relative amounts of the enzymes present at successive stages of the ripening. In results obtained by this method the greatest consideration must be given to increases in the amides and especially in the ammonia. While galactase may increase the amido nitrogen to some extent, this type of decomposition products is more characteristic of the bacterial enzymes. The presence of ammonia may be considered a very good evidence that bacterial enzymes are active in the digestion. Concordant results were obtained from all the cheeses of which bacteriological examinations were made, but, because they were more complete, only those from Cheese VII and Cheese VIII are here recorded.

In Table XII are given the results of an autodigestion of water suspensions made from Cheese VII and Cheese VIII as soon as they were received. They were at this time 5 days old but were practically fresh cheeses as they had been held most of this time at a low temperature. The bacteriological examinations showed a large number of lactic-acid bacteria and liquefying cocci.

TABLE XII.—*Digestion in water suspensions, made from Cheese VII and Cheese VIII, when 5 days old.*

Cheese number.	Ripening temperature.	Age of extract.	Percent nitrogen of cheese in the form of—			
			Total soluble.	Albumoses and peptons.	Amides.	Ammonia.
	° C.	Days.				
VII	10-12	0	0.24	0.14	0.10	0.00
		85	1.60	.57	.96	.07
		134	1.81	.47	1.23	.11
VIII	23	0	.21	.15	.06	.00
		85	1.53	.51	.91	.11
		134	1.62	.51	.99	.12

The digestions from the two cheeses show some differences but these are no greater than would be expected to occur in duplicate flasks from the same cheese, and they may be considered as having been practically indetical at this time. The distinct increase in both the amido and the ammonia nitrogen indicates that bacterial enzymes had already been formed in small quantities. It should be remembered, however, that these enzymes were working under favorable temperature and moisture conditions for a long period of time. Under these conditions we would expect, from a typical bacterial digestion, a more extended decomposition which would be indicated by a higher ammonia content. In cheese ripened at this temperature we would expect to find a considerably higher percentage of ammonia at 134 days, although the small amount of moisture would be much less favorable to enzyme action. This point is well illustrated by the analysis of Cheese VIII made when it was approximately the same age as the water extract on its last analysis. For convenience of comparison these analyses are arranged in another table.

TABLE XIII.—*Comparison of digestion of Cheese VIII and of initial water extract of Cheese VIII.*

	Held at	Age.	Percent nitrogen of cheese in the form of—			
			Total soluble.	Albumoses and peptons.	Amides.	Ammonia.
	° C.	Days.				
Cheese VIII.....		5	0.21	0.15	0.06	0.00
Extract of Cheese VIII		0	.21	.15	.06	.00
Cheese VIII.....	23	136	1.50	.56	.75	.19
Extract of Cheese VIII.....	23	134	1.62	.51	.99	.12

There was, as might be expected, a somewhat higher percentage of total soluble nitrogen in the water extract. On the other hand there was in the cheese, where the conditions were less favorable, a much higher percentage of ammonia, indicating a deeper decomposition.

The objection may be made that the difference in favor of the cheese may be due to the inhibitory effect of the chloroform contained in the cheese extract. While little work has been done on bacterial enzymes, it is well known that chloroform has, at most, only a slight inhibitory effect on most enzymes. In the following table, which gives the results obtained from a digestion made as above from Cheese VIII when it was completely ripe, there is nothing to indicate that the bacterial enzymes were inhibited:

TABLE XIV.—*Digestion in water extract made of Cheese VIII, when 37 days old.*

Age of extract (days).	Percent nitrogen of cheese in the form of—			
	Total soluble.	Albumoses and peptons.	Amides.	Ammonia.
0	1.05	0.45	0.49	0.11
64	1.76	.87	1.20	.19

In these flasks there was a large increase in soluble nitrogen, with a marked accumulation of amides and ammonia. In other words, this was a typical bacterial digestion, and when it is compared with the initial digestion given in Table XII must be taken as indicating the elaboration of bacterial enzymes during the ripening of the cheese. If we compare this digestion of Cheese VIII with one made, at the same time, of its duplicate, Cheese VII, held at a lower temperature, we find a weaker power of self-digestion.

TABLE XV.—*Digestion in water extract made of Cheese VII, when 37 days old.*

Age of extract (days).	Percent nitrogen of cheese in the form of—			
	Total soluble.	Albumoses and peptons.	Amides.	Ammonia.
0	0.79	0.42	0.30	0.07
64	1.52	.47	.95	.10

In comparing these two tables it must be remembered that the initial amounts of by-products were higher in Cheese VIII. When this is taken into consideration it will be noted that, while the increase in total soluble nitrogen did not differ greatly, the production of amides and ammonia was distinctly greater in the extract from the high-temperature cheese.

This difference is even more marked in the results of digestions made when the cheeses were 93 days old and given in the following table:

TABLE XVI.—*Autodigestion of Cheese VII and Cheese VIII, when 93 days old.*

	Ripening temperature.	Age of extract.	Percent nitrogen of cheese in the form of—			
			Total soluble.	Albumoses and peptons.	Amides.	Ammonia.
	° C.	Days.				
Cheese VII.....	10-12	0	1.07	0.61	0.40	0.06
		97	1.38	.32	.95	.11
Cheese VIII.....	23	0	1.80	.57	.65	.08
		97	2.12	.30	1.59	.23

It is very evident from these results that the high-temperature cheese possessed much greater power of self-digestion than Cheese VII ripened at a lower temperature. This difference could be explained only by the development of proteolytic enzymes in Cheese VIII during its ripening. From this it seems reasonable to draw the conclusion that, while in the high-temperature cheese, bacterial enzymes were elaborated, forming amides and ammonia, the low temperature at which Cheese VII was held, by inhibiting the vital activity of the bacteria, checked the formation of similar enzymes. It is at least evident that there were, even in the low-temperature cheese, enzymes, in all probability of bacterial origin, able to break down the proteids into the flavor-forming amides and ammonia.

No sharp line can be drawn between the parts of this work done by galactase, by pepsin, and by the bacterial enzymes, but it is certain that the work of the pepsin ended with the peptons; galactase probably produced a considerable part of the higher decomposition products included under the heading "Albumoses and peptons," and part of the amides; the ammonia was, in all probability, the result of the activity of bacterial enzymes. The formation of ammonia presupposes the ability to form amides. This removes the necessity for accounting for the production of flavor through any intracellular action and explains the accumulation of amides and ammonia in cheese with the resulting flavors, after the bacteria have almost entirely disappeared.

SOURCE OF BACTERIAL ENZYMES IN CHEESE.

In considering the source of ammonia-forming enzymes, only two groups of bacteria, the lactic and the liquefying, need be taken into account. This does not mean that the number of kinds of bacteria possibly connected with the formation of flavors in cheese is narrowed down to two species or even to two groups of closely related species. Each of the groups mentioned includes many species, many of them differing widely in most respects but agreeing more or less closely in certain physiological functions.

The lactic-acid bacteria.—Freudenreich and Jensen have long maintained that this group, or at least certain species of this group, digest proteids presumably through the agency of proteolytic enzymes; but they have failed to prove that such enzymes are secreted. The work of Chodat and Hoffman-Bang, and Nichol森, giving only negative results, has already been cited.

In the bacteriological examinations made of cheese, as already described herein, one species of this group was found which liquefied gelatin very slowly. This action was so slow that it would ordinarily be entirely overlooked and the organism classed with the lactic-acid bacteria. When grown in ordinary milk, an acid curd was formed which remained unchanged. To determine the effect of this organism on milk in which the inhibiting action of the acid had been removed, inoculations were made into flasks of sterile milk containing a small amount of calcium carbonate. The series included also inoculated milk without calcium carbonate and uninoculated sterile milk. All of the inoculated milks curdled. On shaking, the curd separated from the whey, becoming finely divided in the calcium carbonate flasks, while in the others it remained in large tough lumps. Gelatin plates made when the flasks were opened for chemical analysis showed the presence of the inoculating organism in large numbers. At this time all of the inoculated flasks gave a strong reaction with Fehling's solution. The chemical analysis made of these milks when 24 days old is given in the following table:

TABLE XVII.—*Digestion of milk by lactic-acid bacterium 214 dd.*

Treatment.	Per cent nitrogen of cheese in the form of—				
	Total.	Casein.	Total soluble.	Amides.	Ammonia.
Not inoculated, no CaCO_3	0.52	0.46	0.06	0.02	0.00
Inoculated, no CaCO_3		.45	.07	.06	.00
Inoculated, CaCO_3		.33	.19	.11	.00

This organism evidently had a weak proteolytic action when grown in milk containing sufficient calcium carbonate to combine the acid formed, but, on the other hand, had no effect on the casein when the acid was not neutralized. In cheese the duration of the lactic bacteria in comparatively high numbers until the sugar is entirely fermented indicates that a large part of the acid is neutralized. Some may be combined with certain of the ash constituents, but it is probable that the greater part is taken up by the casein. In butter, on the contrary, where the proportion of casein is very much smaller, the lactic bacteria disappear rapidly, leaving a large part of the sugar intact.

The action of the enzyme of this organism on cheese was determined in the following manner: A flask of milk with CaCO_3 , in which 214 dd

had been growing at 30° C. for 30 days, was filtered through a Chamberland filter. Two lots each of 25 grams of well-ripened cheese were triturated with sand, 171 c. c. water added, and both heated in a steam bath for 30 minutes at 95 to 100° C. Twenty-five cubic centimeters of the filtrate was added to one before heating and an equal amount to the other after heating. Four cubic centimeters (2 per cent by volume) of chloroform were added and the flasks sealed and held at 23° C. The analysis, made at the end of 42 days, is given in the following table:

TABLE XVIII.—Showing the action of enzyme of 214 dd on sterilized cheese.

	Percent nitrogen of cheese in the form of—			
	Total soluble.	Albumoses and peptons.	Amides.	Ammonia.
Heated enzyme.....	1.30	0.64	0.58	0.13
Unheated enzyme.....	1.29	.66	.50	.13

Although a considerable quantity of the digested milk was added to this cheese extract, the amount of enzyme was so small that it caused no appreciable increase of the soluble nitrogen or the decomposition products. In view of the weak proteolytic action of this organism, even under the most favorable artificial conditions, and the exceedingly small amount of enzyme which was secreted under these circumstances, it seems improbable that it could have any important part in the formation of amides and ammonia in cheese. This appears even more improbable when we consider the amount of enzyme of this type which was evidently present in the high-temperature cheese at a comparatively early date.

The liquefying bacteria.—Under this heading is included a large group of bacteria characterized by their ability to peptonize gelatin. It is this group that is most commonly associated with the cheese-ripening processes. In this work two organisms were studied as types of the liquefying bacteria. One of these, 214 x, which liquefied gelatin rapidly, occurred in comparatively small numbers in all the cheeses examined, and may be taken as a type of the resistant bacteria whose spore formation enables them to exist in cheese after the conditions have become unfavorable to growth. The other, 214 q, liquefied gelatin more slowly, and, while it was present in the cheese in large numbers for a few days, it decreased rapidly and in course of time usually entirely disappeared. When these bacteria are inoculated into milk and held at a favorable temperature, their proteolytic action is soon made evident by the coagulation of the milk and the rapid digestion of the curd. There is, apparently, a difference in the nature of the digestion brought about by these two bacteria. In milk inoculated with 214 x the casein is completely digested, the fluid becomes rather dark-colored, and in course of time small bundles of crystals

separate from it. With 214q the casein is not completely digested and the clear fluid remains much lighter colored than is the case with 214 x.

In testing the effect of the enzymes of these bacteria on cheese, a water extract was made, as before, from lots of 25 grams each of cheese. The enzymes present were destroyed by heating the cheese one-half hour in a steam bath. To this was added 10 c. c. of the filtrate obtained by forcing a well-digested milk culture through a Chamberland filter. Control flasks were made by heating the filtrate in a steam bath for 20 minutes before adding it to the cheese extract. Two per cent by volume of chloroform was added and the flasks were held at 23° C. The chemical analyses of these cheese extracts, made after an interval of 90 days, is given in the following table:

TABLE XIX.—*Digestion of cheese extract by enzymes from liquefying bacteria.*

Filtrate from culture of—	Treatment of filtrate.	Per cent nitrogen of cheese in the form of—			
		Total soluble.	Albumoses and peptons.	Amides.	Ammonia.
214 q.....	Heated	0.96	0.33	0.57	0.06
	Unheated	1.48	.31	1.06	.11
214 x.....	Heated	.80	.24	.48	.08
	Unheated	2.24	.88	1.22	.14

The filtrate from the milk cultures of each of these bacteria brought about an extensive change in the composition of the cheese extract. This is especially noticeable in the increased content of the simpler decomposition products. In the case of the enzyme from 214q, the increase in soluble nitrogen was entirely confined to the amides and ammonia; the amount of soluble proteids remained unchanged.

It seems highly probable that, in the early stages of the ripening, various liquefying bacteria secrete, or possibly liberate, by the disintegration of their cells, proteolytic enzymes, which by long-continued action have a distinct influence on the nature of the by-products and consequently on the flavor of the ripened cheese. It is unlikely that this ability is confined to one or even to a very few species, although it is probable that different species may, by differences in the amount or nature of the enzyme secreted, produce variations in the product. These questions can be settled only by a more accurate knowledge of the kind and proportion of the amides normally present in ripe cheese, and of the physiology of the bacteria found in cheese.

SUMMARY.

A review of the literature on the ripening of Cheddar cheese shows that the important changes in the ripening process probably take place as follows:

First, a combination of lactic acid, liberated by the fermentation of the milk sugar by the lactic-acid bacteria, with paracasein, forming

the monolactate of paracasein. This compound, insoluble in water, is formed during the manufacture and in the very early stages of ripening.

Second, the gradual transformation of this insoluble body into compounds soluble in water, chiefly albumoses, peptons, and a small amount of the higher amides. This change is probably brought about by the combined action of the two enzymes, galactase secreted with the milk, and pepsin introduced in the manufacture as a contamination of the rennet. The change to this point results in the "breaking down" of the curd and the softening of the texture, but does not produce the typical cheese flavor.

Third, a gradual accumulation, mostly in the later stages of the ripening, of the numerous compounds of the amide group and their further decomposition into simpler amides and into ammonia. The increase of this group is coincident with, and is usually considered to explain, the increasing intensity of the flavor and aroma. The flavor and aroma are probably still further changed and intensified by a rearrangement of the proportions of the individual amide bodies present.

The presence of this group of compounds in the amounts normally present in cheese can not be explained by the activity of pepsin and galactase. The action of pepsin ends with the peptones; galactase forms amides only in small amounts, even under the most favorable conditions and never produces ammonia. The elimination of pepsin and galactase as possible factors leaves as the most probable cause the action of bacteria, either direct through the metabolism of the cells or indirect through the agency of bacterial enzymes. The bacterial hypothesis is still further supported by the fact that the increase of amides is largely prevented, and that of ammonia entirely, by the presence of antiseptics.

In this paper are given the results of bacteriological investigations made on three pairs of duplicate cheeses; one cheese of each pair was held at a low temperature (8° to 12° C.) and one at a comparatively high temperature (23° C.). In all cases the high-temperature cheeses ripened rapidly and soon developed a strong overripe flavor, while the low-temperature cheeses ripened slowly and retained an agreeable flavor for a long time. The bacteria in the high-temperature cheeses decreased rapidly, and before the cheeses were thoroughly ripened had reached unimportant numbers. The increase in amides and ammonia continued after the bacteria had nearly disappeared. In the low-temperature cheeses the decrease of the bacteria was slower and more gradual, but continued until the number present was comparatively small. There was no increase in bacteria in any cheese at any time.

The total bacteria was made up almost entirely of bacteria of the lactic class. In one pair of cheeses, at least, this included a lactic-acid-forming bacterium, liquefying gelatin very slowly and bringing about a slight proteolysis of casein in milk if the acid was neutralized.

Gelatin-liquefying bacteria were present during the first few days of the ripening in considerable numbers; after a rapid initial decline they persisted in comparatively small numbers, but in the course of time usually disappeared almost entirely. In all cases the high initial number was made up almost entirely of a coccus forming on gelatin small, round colonies with a saucer-shaped liquefaction. There was no differentiation, qualitative or quantitative, in the bacteria that could account for the marked differences which existed between the high and the low temperature cheeses.

Autodigestions of these cheeses at different periods of the ripening, made in a way that excluded the action of organisms without inhibiting the activity of the enzymes, indicated that—

1. In the fresh cheeses bacterial enzymes were present in amounts sufficient to produce only a slight increase in the amides and ammonia.

2. In the ripe cheeses bacterial enzymes were present in quantities sufficient to produce a marked increase in amides and ammonia. This was true of all the cheeses.

3. Bacterial enzymes were formed at an earlier period and in greater quantity in the high-temperature cheeses than in the cheeses ripened at a low temperature.

Certain of the liquefying bacteria were able to secrete proteolytic enzymes, which, when added to sterile water suspensions of cheese, caused a marked increase in the amides and ammonia. A lactic-acid bacterium which was able to digest neutralized milk did not secrete, under these conditions, sufficient enzyme to change appreciably the amount of soluble nitrogenous constituents of cheese extract.

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(Continued on page 3 of cover.)

U. S. DEPARTMENT OF AGRICULTURE.

BUREAU OF ANIMAL INDUSTRY—BULLETIN No. 63.

D. E. SALMON, D. V. M., CHIEF OF BUREAU.

FOOT-ROT OF SHEEP:

ITS NATURE, CAUSE, AND TREATMENT.

BY

JOHN R. MOHLER, V. M. D.,

Chief of Pathological Division, Bureau of Animal Industry,

AND

HENRY J. WASHBURN, D. V. S.,

Acting Assistant Chief of Pathological Division, Bureau of Animal Industry.



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LETTER OF TRANSMITTAL

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF ANIMAL INDUSTRY,
Washington, D. C., September 27, 1904.

SIR: I have the honor to transmit herewith a paper entitled "Foot-rot of sheep: Its nature, cause, and treatment," by John R. Mohler, V. M. D., chief, and Henry J. Washburn, D. V. S., acting assistant chief, of the Pathological Division of this Bureau.

Owing to the magnitude of the sheep industry in this country and the serious character of the disease in question, it is of prime economic importance that our sheepmen should be in possession of full information concerning the nature, cause, and treatment of this malady. The authors have endeavored to present these matters in a clear and comprehensive manner by means of an analysis of the previous knowledge of the subject, supplemented by original investigations and experiments undertaken for this work.

Foot-rot of sheep, while not usually fatal in its results, is nevertheless a possible source of great danger and loss to sheep owners because of its highly contagious nature and the frequent violence of its outbreaks, whereby the animals become stunted, owing to the slow, protracted course of the disease; to all of which must be added the difficulty of completely eradicating the virus from the soil and premises.

In view of these considerations, I recommend the publication of the article as Bulletin No. 63 of the Bureau series.

Respectfully,

D. E. SALMON, *Chief of Bureau.*

Hon. JAMES WILSON,
Secretary of Agriculture.

CONTENTS.

	Page.
Introduction	5
Name and synonyms	5
Historical review	7
Symptoms and lesions	9
Course and susceptibility	11
Contagion	12
Bacteriology	15
Pathogenesis	19
Inoculation of sheep	19
Direct, by pus from affected foot	20
Indirect, by cultures	21
Subcutaneous inoculations	23
Feeding experiments	23
Injection of filtrates	24
Inoculation of rabbits	24
Inoculation of mice	25
Inoculation of guinea pigs	25
Virulence for other animals	25
Economic importance	26
Differential diagnosis	29
Wounds of the feet	29
Purulent inflammation of the interdigital spaces (fouls)	30
Stoppage of biflex canal	31
Suppurative cellulitis (cutaneous abscesses)	32
Foot-and-mouth disease	33
Prevention	34
Treatment	35
Bibliography	39

ILLUSTRATIONS.

	Page.
FIG. 1. Hoof showing effects of chronic foot-rot.....	10
PLATE 1. <i>Bacillus necrophorus</i> from foot-rot of sheep	16
2. Fig. 1— <i>Bacillus</i> of necrosis. Fig. 2—Necrotic area in liver of rabbit..	16
3. Development of colonies of <i>Bacillus necrophorus</i>	16

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By JOHN R. MOHLER, V. M. D.,

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Acting Assistant Chief of Pathological Division, Bureau of Animal Industry.

INTRODUCTION.

The sheep is the natural host of many species of internal animal parasites, and surrounding it externally are numerous carnivorous animals which merely await a convenient opportunity to fall upon and devour their helpless victim. Contagious and infectious diseases also play an active part in reducing the income from the sheep industry. They not only destroy many valuable members of the flock, but, more serious still, a greater number than the total of those which actually succumb to the disease will become weakened, debilitated, and unthrifty, and may remain during an entire season a source of worry, discouragement, and expense to those who had planned to derive benefit from them. In this way the loss sustained by the owner and feeder, while not tangible enough to be estimated accurately, is nevertheless very considerable. Among the destructive communicable diseases that always run a slow protracted course, and which at times kill off the sheep, may be mentioned helminthiasis (the affection due to parasitic worms), scabies, and foot-rot. These scourges are probably formidable to the American shepherd in the order named, and in that order destroy or lessen his receipts from an otherwise profitable industry.

Although foot-rot is not so widely scattered among the flocks of this country as are some other diseases, it is nevertheless well-known and greatly feared in many sheep-raising and sheep-feeding localities, and therefore it seems desirable to furnish those interested with information regarding the nature, cause, and treatment of this disease.

NAME AND SYNONYMS.

For many years writers on topics of economic importance to livestock owners have made mention of troublesome affections to which

the feet of sheep are liable, designating them collectively as foot-rot. Under this term all varieties of lameness, whatever the cause, were described. As a result much confusion followed and many controversies arose regarding the nature of the disease to which the name foot-rot was applied. Some writers argued that the disease was contagious, others claimed that it was not, while still others stated that foot-rot was merely a form of foot-and-mouth disease. Thus the term foot-rot became very ambiguous and it was necessary to be familiar with the views of the individual writer in order to know whether it was applied to the so-called benign form of foot-rot, to the contagious form of the disease, to wounds of the foot, to cutaneous abscesses, or to foot-and-mouth disease. It naturally followed that a writer describing the first-mentioned malady claimed that it was noncontagious, while another working with the second disease would assert its contagiousness. It is probable that the nomenclature is responsible for this unfortunate confusion, and therefore it is proposed to differentiate these diseases and to give an appropriate name to each affection, believing that there is as much difference between the so-called benign and the contagious forms of foot-rot as there is between mycotic stomatitis and foot-and-mouth disease. For this reason the so-called benign foot-rot, which results from simple mechanical irritation, will be called purulent inflammation of the foot, or "fouls," while the nomenclature of Moore, "suppurative cellulitis," is retained for the cutaneous abscesses involving the feet. For the contagious foot-rot is preserved the term "foot-rot," and by this name we refer to the chronic inflammation of the foot followed by ulceration, softening of the hoof, formation of a fetid, sticky discharge, occasioning lameness and due to the *Bacillus necrophorus*.

The true foot-rot, as last described, occurs in a contagious and enzootic form among sheep, attacking their feet and spreading from one member of the flock to another either by direct or indirect transmission. We likewise, for the reasons mentioned later on, see no cause for considering foot-rot a complication of foot-and-mouth disease, and these two diseases are recognized by us as individual specific affections, each produced by an infectious principle and in no way related one to the other.

English writers have usually adopted the term "contagious foot-rot" in their descriptions of this affection. Those who employ Latin names in their theses on medical matters refer to foot-rot as "*paronychia ungularis ovium maligna*," and to one conversant with this language the name proves helpfully descriptive. "*Pietin contagieux*" is the name by which the disease is designated by French authors. German pathologists seldom refer to the malady except in articles devoted to a discussion of its relation to contagious foot-and-mouth disease as seen in sheep. When they require a specific name for the

disease, one wholly independent of foot-and-mouth disease, they employ the excellent term "*bösartige Klauenseuche der Schafe*."

Under these names the troublesome affection has been universally recognized in veterinary literature, and, although it hardly seems to have attracted the attention which its destructive character deserves, the general descriptions of the lesions of the disease have been remarkably harmonious.

HISTORICAL REVIEW.

Foot-rot was first described by Chabert in the year 1791 as existing north of the Pyrenees on the banks of the Gironde and Lower Medoc. Later it spread to central France, and was described by Pictet in 1805 and by Gohier in 1808, both of whom declared it to be a communicable disease. It was likewise observed about this time in Piedmont, Italy, and spread into Germany about 1815 as a result of the introduction of French Merinos. Not only has it appeared in epizootic form in continental Europe, but it has also spread through Great Britain, Australia, and the United States, where it was not infrequently observed during the past century.

The date of its first appearance on American soil is unknown. The statement has frequently been made that the disease was brought to American shores by the colonists through importations of Spanish Merinos, and this statement seems to have been accepted by many writers without question or discussion. The first importation of Spanish Merinos for breeding purposes is reported to have been made in the year 1808, but the disease had become well established in this country prior to that time. Another reason for considering sheep from Spain very improbable as originators of the disease upon American soil is the fact that the sheep of Spain have been remarkably free from foot-rot. It is even asserted that it has never been seen on the dry table-lands which constitute the pastures of the entire region south of the Pyrenees. Spanish Merinos may have introduced the disease here, but it is very probable that they were first shipped from Spain to some other country, and thence, after a longer or shorter stay in their new home, reshipped, together with an infection of foot-rot, to America. It has been historically stated that the first settlers who attempted to establish flocks of sheep upon the prairie farms of Ohio, Indiana, and Illinois met with most disheartening experiences, which were in a measure due to the spread of foot-rot. In the year 1797 an agricultural settlement was made in Illinois by farmers from the Eastern colonies, who brought with them flocks and herds of the sheep and cattle common to the section of country whence they came. During the decade following many new homes were established in the prairie regions, and a number of the new settlers brought with them foundation stock with the intention of growing large flocks of sheep,

but wolves and panthers proved to be very destructive, and liver disease and foot-rot also hindered the establishment of large bands, until finally the pioneers were forced to be content with small flocks that could be constantly housed, guarded, and given careful attention.

The farmers of Maryland and Virginia were taking an increasing interest at this time in improved sheep. They had many discouraging conditions to contend with, and, although it is possible that foot-rot was not known among their flocks at this time, it is certain that much trouble was caused by the appearance of "diseases, dogs, and wolves," and that contagious foot-rot made itself known and feared as early as 1832 in these States.

Owing to the imperfect knowledge at that time of matters pertaining to bacterial diseases, the sheep owners struggled against the spread of foot-rot in their flocks somewhat unsuccessfully, and it often required constant watchfulness and persistent treatment for three or four years to eradicate the disease after it had become thoroughly established upon the premises of the sheep grower.

Later than this, in the late "fifties" and early "sixties," there was a marked revival of interest in sheep raising throughout the Middle West, and at this time many who had previously devoted their energies exclusively to grain or to cattle and hogs concluded to change over to sheep, and the resulting traffic in these animals caused them to be moved about over the country roads and into new sections of the agricultural regions in numbers never before equaled. In several instances these traveling flocks carried foot-rot with them and infected the flocks with which they came in contact along their routes. The States of Ohio, Michigan (southern), Illinois, and Iowa were most seriously infected, and in all of them the disease secured such firm foothold that several years of strenuous combat were necessary before it was even partially subdued. It was during this period that a sheep raiser of long practical experience, in writing from his home State (Ohio) made the statement that farmers in his part of the country had in times past been seriously troubled by the appearance of stubborn outbreaks of foot-rot among their flocks of sheep. In no case, however, had he been able to discover the spontaneous appearance of the disease, but with a little persistent inquiry it had been an easy task to trace the origin of each outbreak to the careless handling of diseased sheep brought from other localities. Since that time the disease has appeared frequently, but its spread has never assumed such alarming proportions, and, owing to a better understanding of the disease, it has been more successfully controlled.

The change from former methods of transportation has much to do with the prevention of such widely spread outbreaks as the one just recorded. Instead of driving large flocks on foot over many miles of highway, they are now conveyed by rail in such a manner that the

possibility of transmitting the contagion to healthy flocks along the route is avoided, except at the railway stock yards, where unloading is necessary. At the more important of these stock yards Federal inspectors are stationed, who are very careful to prevent, so far as possible, the infection of healthy flocks while in transit. The disease is by no means eradicated from the United States, however, and it occurs at irregular intervals in certain localities with as great virulence as it has ever shown, and it is only because of a more complete knowledge of its characteristics that its spread is prevented from becoming more general.

SYMPTOMS AND LESIONS.

The first evidence of an attack of foot-rot to attract the attention of the shepherd is a slight lameness, which rapidly becomes more marked. Previous to this, however, there has appeared a moist area just above the horny part of the cleft of the foot, and this has gradually reddened and assumed a feverish, inflamed appearance. It may first become visible either at the front or back part of the cleft, but usually the erosions make their first appearance at the heel. The inflammation rapidly penetrates beneath the horny tissue, while from the ulcerous opening there exudes a thin, purulent fluid. The lameness has increased and the region of the foot above the hoof is becoming swollen and warm to the touch. The exudate from the erosions contains pus cells, bits of destroyed tissues of the foot, and bacteria. It possesses an odor, pungent and disagreeable, but at the same time very characteristic. The experienced sheep man is frequently able to detect the presence of the disease among a flock of sheep, even though it be while making a casual visit to a strange flock, simply by means of the diagnostic and unmistakable odor which arises from the affected feet. This odor is so pathognomonic of the disease that it would reveal the presence of affected sheep to one familiar with the character of the infection, even before noticing the animals.

The erosion progresses, if no treatment is applied, and there is rapid formation of fistulous passages beneath the horny covering of the foot, while the softer tissues of the interdigital space are gradually becoming degenerated and purulent. The invading microorganisms possess marked burrowing propensities, and the result of their invasion is that large areas of the hoof become loosened from the sensitive tissues lying beneath.

Should the loosened horny tissue be cut away it will be seen that the undermining process has been advanced by the microorganisms until numerous ulcerative channels have been formed which are filled with grayish purulent matter and that the encroachment upon the healthy areas is persistently and constantly being extended. Should but one

of the claws of the foot be primarily affected, the disease may readily spread to the other by means of passages or channels eroded beneath the skin of the interdigital space.

The invasion of the necrotic process may continue until ligaments, tendons, and even the bones are attacked; but before this final stage is reached nature will attempt to repair the damage, and for this purpose the secretion of formative elements in the injured part is greatly increased, until there appears a peculiar growth composed of horny elements, dense epithelial cells, and granulation tissue. These unsuccessful attempts at renewed development of tissue are termed "fungoid growths," and they have been known to materially hasten the shedding

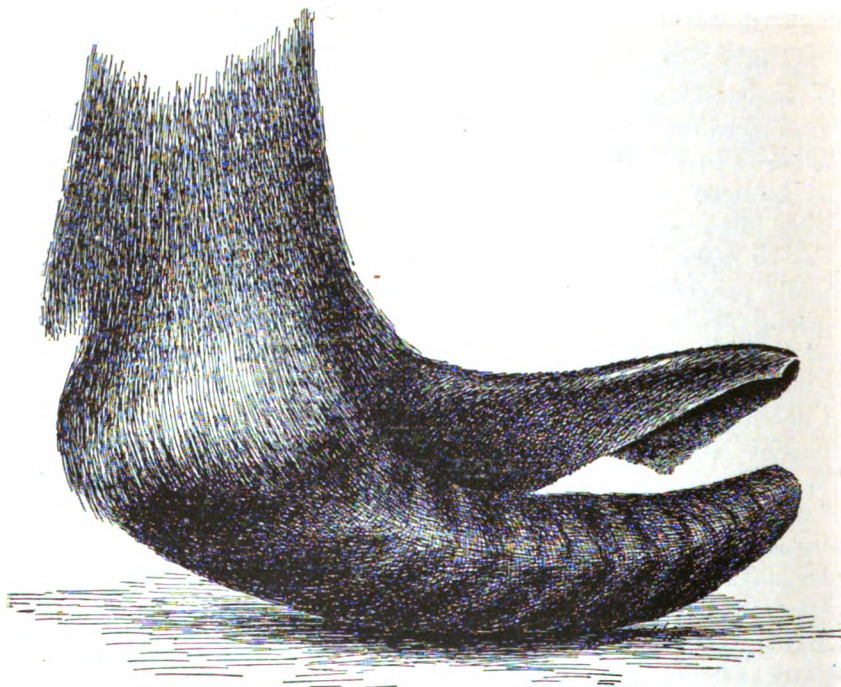


FIG. 1.—Hoof showing effects of chronic foot-rot.

of the horny covering of the foot by their persistent enlargement within the ulcerous channels cut by the advancing infective elements.

The hoof of a sheep suffering from a chronic case of foot-rot grows out rapidly and becomes very hard. It will often be found with the toes so thickened and lengthened that the front part of the foot is raised above its natural incline and the tendons at the heel are subjected to additional strain, all of which tends to increase the lameness and the awkwardness in gait of the victim. These thickened and elongated toes will frequently be seen to have attained an added length of 3 or even 4 inches, and they curl up like sled runners, greatly interfering with the progression of the animal. (See Fig. 1.)

The sheep finds the act of walking so painful when the disease has become thoroughly established that it remains quietly lying in some secluded corner or, if diseased in the fore feet only, crawls around on its knees in its efforts to keep with the remainder of the flock or to get within reach of its food. Its temperature rises until there is evidence of considerable fever. The appetite is seriously impaired and the patient rapidly loses condition and weight.

During warm weather there is great danger of an attack by maggots as soon as the lesions are discharging freely, and unless these are quickly removed they will appear in such numbers as rapidly to bring the course of the disease to a fatal ending. They not only invade the affected feet, but will also locate at any point of the body at which the wool has become sufficiently contaminated by the purulent discharge from the ulcerous tracts to afford them a suitable moistened feeding place. The wool on the sides of the body is frequently more or less soiled from contact with the diseased feet while the animal is lying down, and it is in such areas that the fly deposits the eggs that hatch into destructive larvæ. As soon as the maggots are hatched they begin to burrow into the tissues upon which they are located and they quickly perforate the skin of their host, thus causing complications which bring its suffering to a close.

It having been found that the bacillus of necrosis is the cause of foot-rot in reindeer as well as in sheep, the following description by Horne of the disease in the reindeer of Scandinavia is here given, that the reader may note the great similarity of the course of the disease, as well as the macroscopic lesions produced by this microorganism in the feet of these two species of animals:

One's attention is called to the disease by the fact that the reindeer becomes lame, walks with difficulty, and remains in the rear of the herd. As the disease progresses the affected reindeer becomes unable to follow the rest of the animals in their wanderings and lies down; now the disease advances rapidly and the animal is not able to seek nourishment. It soon becomes emaciated and dies, or falls a prey to wolves or other wild creatures. The disease is located between the claws of the hoof, or at the lowest joint of the limb. The foot swells greatly, so that it resembles a club, and hence the name "club disease." The diseased foot is very tender, preventing the animal from walking upon it. After a while the hide cracks and there appears in the sore a peculiar discharge. The pathological picture of the inflammatory process itself and the transformation of the web into a dry, yellowish green necrotic mass, lead to the opinion that it must have been a process similar to hoof carbuncle and to the other diseases brought about by the necrosis bacillus.

COURSE AND SUSCEPTIBILITY.

The course of this disease is slow and protracted, usually starting with one foot and subsequently involving one or more of the others. During this interval it would probably have likewise spread to the feet of other sheep, and in this way the disease may remain for several months

in each member of the flock and for eight or ten months in the flock itself. When the ulcerous processes have become advanced and aggravated, fever develops, the appetite is lost, and the animal grows so emaciated that death intervenes. In some cases that are left untreated recovery may follow slowly, but there is usually either a dense fungoid growth between the claws, a stiffening of the joints of the ankle, or a long fissured and misshapen hoof. When treatment is properly applied in the early stages of the disease, it is usually cured within ten days. It is very rare for death to occur as a result of foot-rot, although in very virulent outbreaks involving 3 or 4 feet of each sheep the affection may terminate fatally within two or three months.

The course of the disease is also dependent upon the susceptibility of the affected animal. Thus, it is a well-accepted fact that the pure breeds of fine-wooled sheep are especially susceptible to foot-rot, although the pure breeds of coarse-wooled sheep and the grades of both of these breeds of animals are by no means exempt. In the latter animals, however, the disease runs a milder course, and is more amenable to treatment than in the case of the fine-wooled sheep. Sex or age does not appear to have any important influence on the susceptibility of the animals, as the disease manifests itself quite generally in the flock, attacking lambs, yearlings, and aged sheep alike, without regard to their being male or female.

CONTAGION.

Some of the early writers seem to have been convinced that this disease was in no degree contagious, but at a later period many investigators opposed this opinion and strongly maintained that it spread from sheep to sheep by means of some contaminating agent which exuded from the erosions upon the affected feet.

In opposition to these statements many veterinary writers were positive in their declarations that the disease was never caused otherwise than by pasturing on low, swampy lands, or as a result of overgrown toes, or by other conditions due to faulty care and surroundings. This view is concisely presented in the following statement by a writer of prominence:

By nature not unlike the goat it (the sheep) frequents the summits of the lofty mountains, where its hoofs, altogether analogous to those of the horse, are exposed to much wear and tear. When from these alpine regions we transfer the sheep into our grassy lawns, our moorish lands, or sandy soils, this wearing away of the crust is put an end to; it grows too long and proves a great incumbrance. In this state it is necessarily exposed to many injuries, among others from the long grass of the pastures, and itself necessarily injures the soft parts beneath; and hence lameness, inflammation, suppuration, to the extent of casting the hoof, are the consequences. The circumstance of the disease occurring epidemically arises from the whole flock being placed in precisely similar circumstances.

The above paragraph has been widely quoted and seems to have formed the basis of a long list of arguments in favor of the noncon-

tagiousness of foot-rot. But while the majority of writers seem to have denied that the disease possessed any contagious properties, there remained a very lively minority who entered a most vigorous protest against this view of its character, and who cited instance after instance in support of their claim that it was strictly of a contagious nature. They mentioned cases in which affected sheep had been brought from a distance and placed in flocks that had been sound and healthy for years, with the result that a portion of the flock soon became affected; also a case in which healthy and diseased flocks pastured in adjoining fields without any transmission of the trouble until a time when two or three of the sound animals jumped the dividing fence and grazed for the remainder of the day with the contaminated flock, with the result that they promptly contracted foot-rot. These writers recorded the infection of sound flocks as the result of their having been driven over roads which diseased sheep had traversed but a short time previously. Reports were made of test lots of sheep that were pastured for months on swampy and muddy lands without spontaneous development of foot-rot, which promptly became affected, however, on their removal from these pastures when inoculated on the skin between the claws of their feet with discharge from an affected foot. They mentioned several attempts at experimental inoculation with bits of diseased tissue, or with some of the moist excretions from an affected foot, which usually favored the investigator with successful terminations.

One of the best of these experiments was reported by Favré in 1823. He simply moistened the skin between the claws of 32 healthy sheep with matter obtained from diseased feet, with the result that 21 of them contracted the disease in consequence of this slight exposure.

Another convincing argument in favor of the dependence of foot-rot on a specific cause is found in the fact that young lambs yeaned by affected ewes have been known to show unmistakable symptoms of the disease as early as the sixth day after birth, and, as this has occurred in flocks that have been closely stabled, there remains no possibility that the lameness of these lambs could have originated in swampy or muddy pastures.

Additional evidence of the contagious nature of the disease, as well as an example of one of the ways in which the infection may be placed where it will do great harm to innocent parties, will be found in the following account of an outbreak in one of the small country towns of Vermont several years ago. A carload of thin sheep were shipped out from Boston to be fattened on one of the stock farms of that vicinity, with the intention of reshipping to the Boston market when finished. They arrived at their new home in the fall of the year, a season in which there is always great activity among stock owners in preparation for the winter. Many of them were infected with foot-

rot at the time of their purchase, but, in spite of this fact, they were unloaded with the rest of the flock, and all were driven over several miles of country highway from the station to their owner's farm. The result of this journey was that four other bunches of sheep that soon traversed the same route or portions of it became affected with foot-rot in its most virulent form. The owners tried every form of treatment that they could hear of, but only with unsatisfactory results, and the disease was not wholly eradicated from the affected district until the fourth year after its introduction.

Writers of recent years, both in Great Britain and France, have become more and more willing to declare that the disease owes its origin and perpetuation to a specific cause. Many German writers still have the disease inextricably confused with foot-and-mouth disease, and for this reason their literature does not offer the assistance to a student of the ailments of the sheep that one would naturally expect to gain.

Innumerable instances have been recorded in American agricultural periodicals which indicate very clearly that foot-rot of sheep is an affection which is in no respect related to foot-and-mouth disease, and they also show that the disease possesses some contagious principle whereby it may be readily carried from flock to flock or from a diseased to a healthy animal on the same premises.

Among the first experiments made by this Bureau, preparatory to the publication of this article, were some for the purpose of investigating the contagious nature of the disease. It may be of interest to mention in this connection that the material with which our experiments were made was derived from five individual outbreaks of foot-rot in different States and in no way connected one with another. The first case investigated came from a flock of Merino sheep in Ohio. The material obtained to confirm these first results was secured at the Buffalo stock yards from the feet of three affected Shropshire sheep that were shipped from Michigan. The third outbreak was observed at Deerpark, Md., in Rambouillet Merinos, which had been imported into this country only five weeks before. The fourth outbreak investigated was in a flock of sheep near Martinsburg, W. Va., from which a grade Shropshire was received at this office, while the last material obtained consisted of two badly affected Merino sheep from New York State. By means of careful tests performed with the purulent exudate from the feet lesions of these animals it was proved that foot-rot could be produced at will in healthy sheep, not only by spreading a little purulent matter from a diseased foot upon the shaven interdigital skin of sound feet, but quite as readily when bouillon cultures inoculated with some of the discharge from an affected foot were applied in a like manner, even when the cultures used were of the third generation of the original growth.

It appeared from these experiments that the disease was dependent upon a specific organism for its existence, and that this organism could be readily perpetuated by the employment of the usual methods of bacteriological culture.

BACTERIOLOGY.^a

All early attempts to recover an organism from an affected foot that would produce the disease when applied to the foot of a healthy sheep proved failures. It was only by the inoculation of rabbits or mice and the application of anaerobic conditions that the slender, straight or wavy rods, constantly present in the affected feet, could be isolated in purity. A mixed culture obtained by inoculating ordinary nutrient bouillon with pus from a diseased foot was found to retain its virulent principle for at least a month and a half and to the third generation. This culture would produce the disease in the foot of a healthy sheep, the lesion appearing in from three to nine days after its application to the shaven skin in the cleft of the foot. First a moist condition of the surface of the skin was noticed, followed by various inflamed spots,

DESCRIPTION OF PLATE 1.

FIG. 1.—*Bacillus necrophorus* from a 10-day-old bouillon culture stained with Loeffler's methylene blue.

FIG. 2.—Ten-day-old bouillon-agar growth of this bacillus stained with Loeffler's methylene blue.

FIG. 3.—Cover-glass preparation showing the bacillus of necrosis obtained from the purulent exudate from the foot of sheep No. 108 after artificial inoculation with pus from a case of foot rot.

FIG. 4.—Forty-eight-hour-old bouillon culture showing short forms of *Bacillus necrophorus* obtained by inoculating this medium with the material represented in figure 3.

FIG. 5.—Cover-glass preparation made from the pus of a foot affected with a long-standing spontaneous case of foot-rot and showing the presence of various micro-organisms, including *Bacillus necrophorus*.

FIG. 6.—Cover-glass preparation made from the purulent discharge from foot of sheep No. 88, seven days after the application of a pure culture of the necrosis bacillus that had been obtained from a case of foot-rot.

These six camera-lucida drawings were made at the base of the stand with Zeiss No. 4 compensating ocular and 2 mm. oil immersion objective.

DESCRIPTION OF PLATE 2.

FIG. 1.—Cover-glass preparation made from gelatin-agar colony obtained from the liver of a rabbit, which was the third in a series inoculated from the foot of an infected sheep. Stained with Loeffler's alkaline methylene blue. Camera-lucida drawing made with Zeiss No. 6 compensating ocular and 2 mm. oil immersion objective.

FIG. 2.—Liver of rabbit which died twelve days after the subcutaneous inoculation of *Bacillus necrophorus*. Stained with Loeffler's alkaline methylene blue. Camera-

^a A more detailed description of the *Bacillus necrophorus* will be given in a forthcoming publication on necrotic stomatitis (calf diphtheria).

lucida drawing made with Zeiss 4 mm. objective and No. 6 compensating ocular. Notice the invasion of the normal liver structure by the necrosis bacilli arranged along the border of the necrotic focus.

DESCRIPTION OF PLATE 3.

FIG. 1.—Bouillon-agar culture (first dilution) of *Bacillus necrophorus*, showing 24-hour growth, with numerous small gas bubbles, but the colonies have not developed sufficiently to become visible.

FIG. 2.—Seven-day-old bouillon-agar culture of this organism of the fourth dilution. The isolated colonies are characteristic in that their grayish centers are surrounded by fuzzy white areas, not unlike the strands of loose, fleecy cotton.

FIG. 3.—Single colonies of the necrosis bacillus, showing this filamentous character of their growth (enlarged about seven diameters).

which rapidly spread and coalesced. Within twenty-four hours of the appearance of the reddened spots, the characteristic burrowing propensities of the disease were in full evidence, and the hoofs were soon undermined.

Microscopical examination of the purulent material discharged from the open sore of a case of foot-rot revealed the constant presence of various microorganisms (Pl. 1, fig. 5), and similar examination of the mixed bouillon culture that had proved virulent when applied to healthy sheep showed that some of these bacteria were still present in the latter material. Various micrococci, or round forms, were present in both samples. Plump bacilli with rounded or blunt ends were also frequently observed, and either these or the cocci would readily grow under common methods of bacteriological culture, when isolated in pure culture, but neither of them would show lasting harmful effects when placed upon the foot of a healthy sheep. That such a condition of mixed infection should occur must appear perfectly natural when it is considered that the affected foot is exposed to the manure and filth of the stable and to the mud and dirt of the pasture; and it is this constant presence of extraneous, saprophytic microorganisms that is a factor in making the isolation of the causative agent more difficult. However, there appeared in each sample placed under the microscope long, straight or wavy baccilli which were found to compose fully one-half of the number of organisms and which it was impossible to separate from the other forms by any of our methods of plating (Pl. 1). These baccilli were not of sufficient similarity, however, to lead one to suspect that they were related organisms; those found in smears taken directly from the affected foot appearing as long lines or threads, while those discovered in the mixed bouillon culture were shorter, more slender, and never united in long filaments, usually appearing singly or less frequently in pairs (Pl. 1, fig. 4). Later observations, however, showed these to be but differing forms of the same organism, the differences being due to the conditions surrounding their growth. It was found by repeated tests that the shorter separate forms present in the mixed bouillon cultures would produce the long filamentous forms when inoculated upon sheep or rabbits, and, conversely, the results

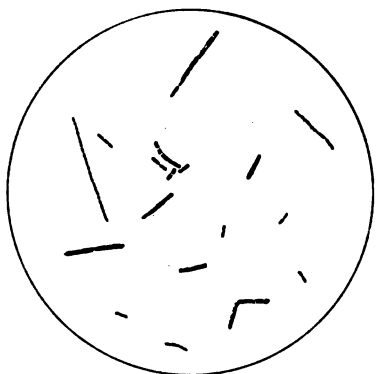


FIG. 1.

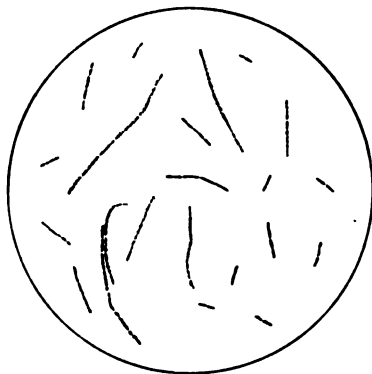


FIG. 2.

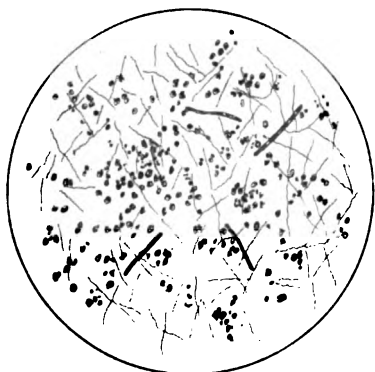


FIG. 3.

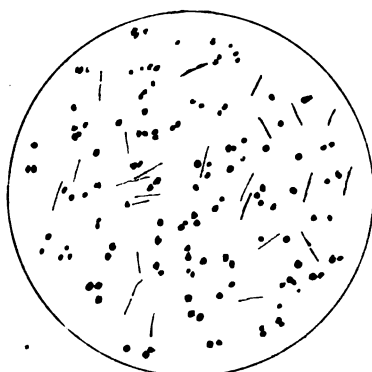


FIG. 4.

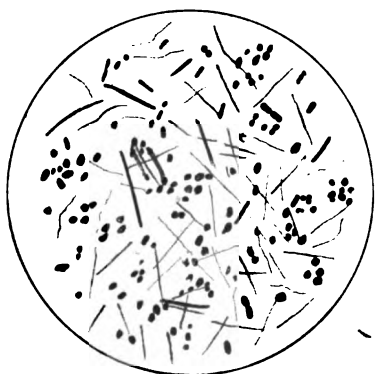


FIG. 5.

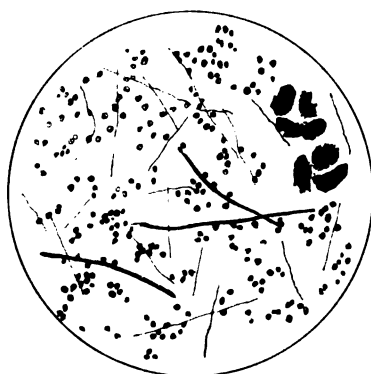


FIG. 6.

BACILLUS NECROPHORUS FROM FOOT-ROT OF SHEEP.

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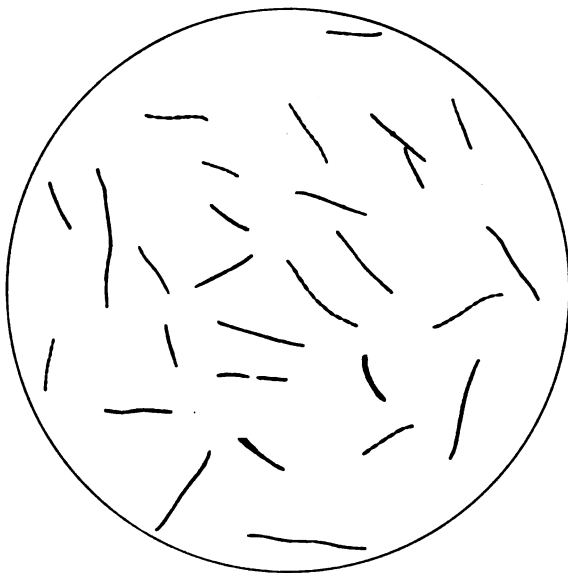


FIG. 1.—BACILLUS OF NECROSIS.

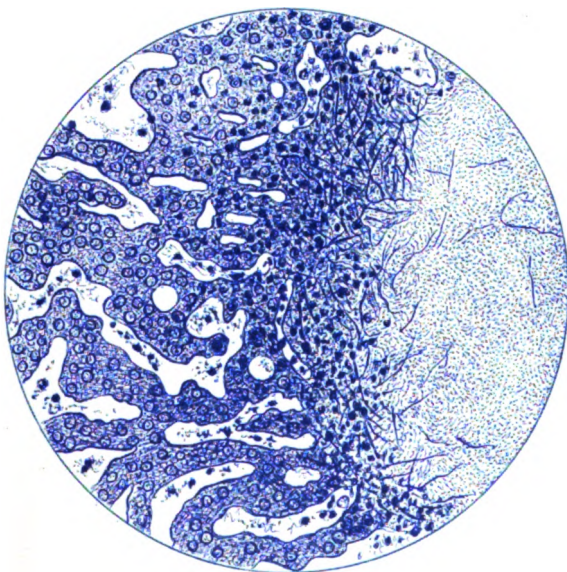


FIG. 2.—NECROTIC AREA IN LIVER OF RABBIT.



FIG. 1.

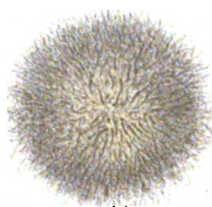


FIG. 3.



FIG. 2.

DEVELOPMENT OF COLONIES OF *BACILLUS NECROPHORUS*.

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obtained by growing these long filaments in mixed culture in ordinary bouillon, or in pure culture in rabbit bouillon, gave a reappearance of the shorter single forms so uniformly present in all previous examinations of the bacillus when derived from like environment.

The isolation of this bacillus from the other forms of bacteria present offered many difficulties, and if it were not for the peculiar susceptibility of the rabbit to this organism it would be a task closely bordering on the impossible, as viewed in the light of present laboratory methods.

Having become convinced that foot-rot could be readily transmitted from diseased to healthy sheep by the use of mixed cultures, as well as by pus obtained from the diseased surface and applied to the interdigital space of the sound foot, it became desirable to obtain directly from the sheep a culture of the organism which is immediately responsible for the spread of the inflammation into the tissues of the healthy animal. To accomplish this end recourse was had to the following plan: A healthy foot of a fresh sheep was carefully washed, then sterilized by the application of 5 per cent carbolic acid, later washed with sterilized water, immediately inoculated from the foot of a diseased sheep which was occupying a box stall near by, and then wrapped up in rolls of sterile cotton, over which a close linen wrapper was loosely bound. In this manner much of the contamination from contact with the stable floor was avoided, and the organisms which under these coverings could multiply and cause ulcerous inflammation must closely represent the universal agent to which the spread of foot-rot is due. Plate 1, fig. 3, represents the appearance of smears taken during the initial stages of the inflammatory process from a foot thus treated.

Having under these precautions obtained material for further inoculations, one should now rely upon the rabbit or white mouse for the complete isolation of the causative bacillus.

The subcutaneous inoculation of a rabbit with a small amount of the watery excreted matter from a diseased sheep's foot will result in the death of the rabbit in four to seven days. A second or perhaps a third rabbit must now be used before one may hope to obtain a pure culture of this bacillus. The first rabbit will, however, in spite of the contaminating microorganisms present in the material used in its inoculation, show very characteristic lesions which can be referred to the action of no organism other than the bacillus of necrosis. The chief of these typical changes will be noted at the point of inoculation, where, on the removal of the skin, will be found an irregular area, about 1½ to 2 inches in diameter, lying immediately beneath the skin and extending down for a greater or lesser depth into the muscular tissues. This area presents to the naked eye much the appearance of a flattened mass of soft, fresh putty, and to the nose a penetrating odor as of gaseous decomposing flesh.

This pulpy, yellowish white, malodorous mass is the detritus of muscular, fatty, membranous, and vascular tissues which have been attacked and destroyed through the presence and by the effective poisons of the bacillus of necrosis. Extending out into the surrounding tissues for about half an inch in all directions will be found a zone of inflammatory tissue, and the subcutaneous tissues of the abdominal region will appear inflamed and edematous through the gravitation of inflammatory agents from the local lesion caused by inoculation. Examination of the soft mass found in the necrosed area at the point of inoculation, shows that it is penetrated in every direction by long, thread-like bacilli, and a small scraping of this material used for the subcutaneous inoculation of a second rabbit serves to eliminate a large proportion of the contaminating microorganisms. Because of the greater purity of the material now used, the inoculation will not result fatally until a period varying from eight to fourteen days, and in many instances it will be found that this length of time has proved sufficient to allow the circulation to take up a few of the bacilli of necrosis and deposit them in the plexuses of lungs, liver, or kidneys, where small yellowish-white spots of necrosis will result, and from these spots the bacillus of necrosis may be obtained in pure culture.

The *Bacillus necrophorus* advances in its destructive invasion of the healthy tissues which surround focal points with all of the precision of an advancing army. Plate 2, fig. 2, illustrates the invasion of a healthy section of liver from a necrotic focus, and at the same time indicates that the best place to obtain pure cultures of the microorganism is at the line where the area of absolute necrosis is surrounded by a zone of invasive inflammation.

From rabbits that have developed secondary lesions of necrosis in the visceral organs pure cultures of the necrophorus bacillus may now be gained, and their further development may be secured by the utilization of anaerobic methods of culture.

This bacillus, although of nearly uniform thickness, 0.75 to 1μ , may grow to a variety of lengths, and has a tendency under certain conditions toward the formation of long, slender, slightly wavy threads. It is this character of varying from small coccoid rods to long filaments which may reach a length of 100μ that denotes its pleomorphism.

The bacillus being an anaerobe, develops an active growth in the absence of oxygen. A culture medium composed of 1 part of blood serum, 1 part gelatin (10 per cent), and 2 parts agar (1.75 per cent) will support ready growth of the bacillus along the line of the stab below the surface of the mixture. Equally good results in obtaining cultures may be reached by the use of stiffened fluid media as will be derived from relying altogether upon firm, solid material. One of the best, because simplest, preparations will be found to consist of

ordinary bouillon to which sufficient melted agar has been added to afford the mixture, when cooled, the consistency of soft jelly.

Tubes supplied with Martin's bouillon or neutralized rabbit bouillon and inoculated with this organism produce good growths, especially at the bottom of the tubes, when placed in a hydrogen jar.

Gelatin agar is still another satisfactory medium, and develops thrifty colonies.

It has been found necessary to rely upon dilution by transfer from tube to tube through a series of three or four tubes for the obtaining of separate colonies of the bacillus, as our attempts at plating this organism have not been satisfactory. It has been noted that the reduction of the numbers of colonies in tubes of a certain size will always be accompanied by an increase in the dimension of each colony. Plate 3, fig. 1, shows a 24-hour growth of the bacillus in stiffened fluid media (bouillon agar). Numerous small gas bubbles will be noted, but the colonies have not yet developed sufficiently to become visible. These will appear after forty-eight to seventy-two hours' growth as small, yellowish-white specks, around which will later develop a fuzzy, white area, not unlike a covering of loose, fleecy cotton. These characteristic colonies are better shown in the diluted culture (Pl. 3, fig. 2), seven days old.

The organism not only produces gas during the period of its growth in artificial culture media, but the same characteristic is also noticeable in the flesh of rabbits that have succumbed to inoculation. If the carcass of the rabbit is left undisturbed on ice for eight or ten hours after death, there will then be areas present surrounding the seat of inoculation, in which the muscles appear darkened, and the interfibrillar spaces, together with the intermuscular and subcutaneous spaces, will contain small bubbles of gas, and show edematous infiltration.

Development occurs between 30° and 40° C., the temperature most acceptable to the organism being 35° C. It does not stain by Gram's method, but takes the ordinary aniline dyes, often presenting, especially the longer forms, a characteristic beaded appearance (Pl. 1, figs. 1 and 2).

PATHOGENESIS.

INOCULATION OF SHEEP.^a

The readiness with which the disease will spread from sheep to sheep when the flock is kept under suitable conditions for such spreading has been recognized for many years by sheep owners. In addition to

^a We are indebted to Dr. E. C. Schroeder, superintendent of Experiment Station, Bureau of Animal Industry, for the inoculation of many of the sheep in this experiment and for the clinical notes concerning them.

the practical demonstration of its contagious character, which has been given in past years in nearly every sheep-growing State in the Union, numerous experiments have been made by interested investigators in different countries for the purpose of determining the cause of the transmission of the disease from one sheep to another. These experiments have been so comprehensive (see the writings of Brown^a and Law^b) that the preliminary tests one must make in an investigation of the character here recorded are necessarily repetitions of work that has previously been done by others. In spite of this fact several of the experiments commonly made by students of foot-rot have been repeated during this investigation, and the record of some of the successful inoculations with material from diseased feet will be given here merely as a substantiation of the claim that the disease is strictly contagious.

Direct, by pus from affected foot.—Two sheep, Nos. 40 and 63, were inoculated on the scarified interdigital skin with some of the exuded matter from an infected foot, and developed the disease in typical form in seven days in each case.^b

Sheep No. 313 was inoculated with discharge from an infected foot on the shaven surface of the cleft of its foot. This was followed by the appearance of a characteristic inflammation on the ninth day, and the inflammation gradually developed into the usual course of ulceration seen in this disease.

Sheep No. 108 was inoculated upon the shaven surface of the skin of the foot with discharge from a diseased foot, following which a protective application of moist sterile cotton and a linen bandage was applied. A characteristic case of foot-rot developed on the fourth day as a result. It seems probable that the early appearance of the disease in this instance was brought about by the partial exclusion of air and by the retention of more or less moisture upon the treated surface, through the agency of the cotton and bandage.

Lamb No. 94 is of special interest, having been born in an infected stall in December, 1901, and having continued until March 10, 1902, in daily contact with diseased sheep without showing the slightest evidence of lameness. During this period of exposure the stall in which the animals were confined was kept dry and clean. Had mud and moisture been present for the animals to walk about in, in common, the result would doubtless have been different. This test was continued for seventy-nine days, at the end of which time it was seen that the healthy lamb had received no degree of infection, although the disease had slowly continued to advance in the feet of its diseased companions until the affected members had become deeply eroded. Follow-

^aThe figure references are to bibliography at end of bulletin.

^bIn many cases where foot-rot was produced by inoculation antiseptic treatment was applied and a cure effected as soon as the disease had become characteristic.

ing this preliminary test, the lamb was directly inoculated on March 10 by the application of material taken from a diseased foot to both of its feet on the right side. The interdigital spaces of both feet were scraped until the surface became blood tinged, when the watery exudate from the diseased foot of sheep No. 62 was smeared over the scraped surfaces. There appeared on both of these feet in fifteen days characteristic lesions of foot-rot, while the left hind foot also developed this disease from natural infection, although the lamb had previously withstood the danger incident to living in daily contact with diseased sheep. It may be stated in this connection that other negative results were also met with by exposing healthy to diseased sheep, but although seven such experiments did not produce the disease these can in no way offset the positive results obtained, considering that the exposure pens were always clean and dry and unlike the natural conditions under which sheep are usually kept.

Indirect, by cultures.—A review of experiments made with pure cultures of the bacillus of necrosis will serve to show the part which this organism is capable of taking in the development of foot-rot in sheep.

A pure culture of the bacillus was obtained from the liver of a rabbit, which was the third in a series inoculated from the foot of an infected sheep. This pure culture was then applied to the scraped surface of a healthy foot of sheep No. 87. The surface upon which the culture was placed began to show inflammation on the tenth day, appearing reddened and moistened, and exhibiting the presence of considerable heat. For ten days more the irritation appeared to progress, until at the end of that time a painful ulcer, coated with a grayish-white exudate, had formed. Spontaneous healing commenced at this period, but its progress was slow, and microscopic examination of the watery exudation from the ulcerous opening taken nearly two months later showed that many of the long filamentous forms of the necrophorus bacillus were still present in it.

Another healthy sheep, No. 88, was inoculated upon the scraped surface of its foot with the same material as that used in the preceding case. The response was much more prompt (four days) in this case, and the ulceration penetrated the tissues of the foot for about the same depth, while the final healing, which occurred by scab formation, required about the same length of time for its establishment.

A third sheep, No. 89, to which the bacillus was applied in a pure state, showed inflammation of the foot in a few days and by the eighth day was sore and lame as a result. The erosion penetrated beneath the skin of the heels, constantly excreting foul-smelling yellowish pus. Spontaneous healing began to make its appearance in about three weeks after the inoculation, and rapidly progressed to the complete restoration of the foot.

A fourth test of a similar nature gave much the same results, except for a slight loosening of the hoof from a portion of one of the toes.

From the very nature of the conditions surrounding a flock of sheep it must be known that a natural infection by the *necrophorus bacillus* in a pure state is an utter impossibility. There must of necessity be material contamination by various cocci and other bacteria from the floor of the sheep pens, or from muddy yards and runs. Many of these invading forms in all probability offer great assistance to the *necrophorus bacillus* in penetrating normal tissue and in perpetuating and extending the disease.

The character and appearance of the material discharged from a foot inoculated artificially with a pure culture of the *necrophorus bacillus* indicate that there is a slight difference between the disease when produced in this manner and the natural type. The same redness of the surface is noted and the same tendency to send deepening processes of ulceration and degeneration into the depths of the foot may be seen in both, but the discharge will be seen to consist largely of soft yellowish pus in those cases in which the foot has been inoculated with pure culture and the foot afterwards kept dry and clean, while in the natural infection under ordinary barnyard conditions and in cases produced artificially by the application of mixed bouillon cultures the exudate has more of a yellowish gray watery appearance mixed with pus.

There is no noticeable difference in the odor of the affected feet whether the lesions are produced naturally or artificially, and the same disagreeable stench pervades all cultures made from them, especially after these cultures have grown for forty-eight hours or longer in the incubator; and it is a remarkable fact that the same odor may be detected lingering about the carcass of a rabbit which has succumbed to an inoculation with *necrosis bacilli* in all cases, whether the bacteria were derived from cases of foot-rot in sheep or from some other source.

The following experiments were made with tissue containing an abundance of *necrosis bacilli* and with mixed bouillon cultures made from the pus of affected feet.

Sheep No. 83 was inoculated under the skin of the heel with material taken from the center of a necrotic lesion in a rabbit that died as a result of the infection of the *necrosis bacilli*. Here the attack was prompt and serious. The animal was unable to use its foot by the third day, this degree of lameness lasting for fully a week. The organism penetrated beneath the hoof on each toe, causing it to be separated in each instance from the tissues beneath. A profuse discharge was constantly exuding from the point of inoculation, in which

the long threads of the *necrophorus bacillus* could constantly be demonstrated.

Sheep No. 102 was inoculated on the foot by the application of a mixed bouillon culture that had been taken direct from a diseased foot and grown in an incubator for forty-eight hours, at a temperature of 35° C. Foot-rot was well established in the foot by the sixth day following, and its course was rapid and acute.

Goat No. 71 was successfully inoculated by having the skin of its interdigital space bared by the clipping off of the hair and the exposed surface then smeared with mixed bouillon culture of the third generation. As a result of this procedure the disease made itself manifest on the ninth day, and followed a typical course through the various stages of inflammation, spreading ulceration and necrosis.

Subcutaneous inoculations.—In order to test the action of the bacillus of necrosis when applied to sheep upon some part of the body other than the foot, a strong, healthy sheep was inoculated subcutaneously on the inner surface of the thigh with 1 c. c. of a bouillon culture which contained the *necrophorus bacillus* in pure state.

A spreading area of inflammation resulted from this inoculation, making itself apparent upon the third day, and gradually extending until the animal became feverish, off its feed, and showed considerable lameness. In the center of this inflamed area an abscess the size of a hen's egg developed, which ruptured spontaneously after a few days' duration, discharging a quantity of foul-smelling, yellowish watery pus, within which great numbers of *necrophorus bacilli* were swarming. Recovery was rapid after the rupture of the abscess, and in fifteen days after the inoculation all soreness had gone and only a scar remained.

This experiment was repeated with sheep No. 13 by inoculating it under the skin of the left shoulder with 2 c. c. of a bouillon culture obtained from lamb No. 94. Six days later a hard tumor three-fourths of an inch in diameter by one-half inch high had developed at the seat of injection. This lesion likewise remained localized without showing any indication toward involving the deeper structures, and recovery followed in nineteen days.

Feeding experiments.—Two sheep were selected for the purpose of feeding cultures of the necrosis bacillus, in order to disprove that the organism has any predilection for the feet when ingested with the food. These animals, Nos. 15 and 84, each received 100 c. c. of a bouillon culture mixed with mill feed on three successive days. These sheep were slaughtered thirteen months and four months, respectively, after the beginning of the experiment, but the postmortem examination failed to reveal any indication of necrosis in any of the tissues, although the livers especially were subjected to careful examination.

Injection of filtrates.—In the midst of successful inoculations of healthy sheep with artificial cultures of the organism concerned in the production of foot-rot, it was deemed advisable to test the filtrate of some of these virulent cultures to see if there was any ultramicroscopic organism to which the disease could be credited. A 48-hour growth of a mixed bouillon culture that had been inoculated with the pus from an affected foot was divided into two parts, one of which was used without alteration, while from the other a filtrate was obtained by the use of a Roux-Chamberland filter. The two fore feet of a healthy sheep were next prepared for inoculation by scarifying the interdigital spaces, the same treatment being accorded to each of them, and the application was at once made, using on one foot the unaltered mixed bouillon culture, and on the other some of the filtrate derived from it. The inoculation with the culture in which the bacteria remained soon resulted in a serious case of eroding foot-rot, while the foot which received only the sterile filtrate quickly healed. In order to determine if the products of the necrophorus bacillus were in any way concerned in the production of these lesions a similar experiment was tried. For this purpose a rabbit bouillon culture of the necrophorus bacillus of three days' growth was used by retaining a small portion for direct inoculation, while the remainder of the media was passed through the Roux-Chamberland filter. When the unfiltered culture, which was swarming with the above bacilli, was applied to the scraped interdigital space of a foot it soon began to produce the inflammation and lameness which characterize the initial stages of foot-rot, while the foot which received the filtrate after similar treatment remained unaffected.

INOCULATION OF RABBITS.

Rabbits are the most susceptible animals to the inoculation of the *Bacillus necrophorus*, and, as Loeffler has stated, they also afford a ready method for isolating this organism from contaminations. A number of rabbits were inoculated subcutaneously, both with the purulent discharge from a foot affected with foot-rot, as well as with pure cultures of the *Bacillus necrophorus*, and the characteristic yellowish white area of muscular necrosis with the peculiar penetrating odor was prominent in both instances. In the former cases the animals frequently died on the fourth or fifth day, probably as a result of the mixed infection present, but even in these animals the coagulation necrosis of the muscles about the point of inoculation and their transformation into a putty-like consistency was always noted. When pure cultures were used a rabbit would live from eight to fourteen days when injected with 0.5 c. c. under the skin of the back. The resulting lesion is fully described on page 19. It frequently happens when life has been prolonged ten or twelve days that metastasis occurs from

the local lesion, in which cases irregular yellowish areas of focal necrosis are observed most frequently in the liver, and occasionally in the lungs and kidneys. Microscopic examination of the tissues taken from the affected area or from those lesions in the liver or lung that had developed as a result of metastasis shows the presence of typical necrosis bacilli in great numbers. In the case of organic lesions these organisms are seen to be arranged along the border of the area of necrosis, while the central portion is amorphous without showing the presence of any bacilli. (See Pl. 2, fig. 2.)

INOCULATION OF MICE.

White mice may be used in obtaining the necrosis bacillus in purity by inoculating three or four successively. However, their susceptibility to the organisms frequently found in foot-rot makes them less valuable than rabbits for this purpose. The results obtained by the subcutaneous inoculation of 0.1 c. c. of an emulsion prepared from the foot of a sheep suffering with foot-rot and of 0.1 c. c. of a bouillon culture of necrophorus bacilli are practically the same if the mouse in the former instance does not die of some intercurrent disease within three or four days following the injection. The usual course of the disease in these animals ranges from five to eleven days. The first indication noticed is a rapid emaciation of the mouse, with a rough staring coat and a gradual drying-up appearance of the animal. On postmortem examination the point of inoculation was found surrounded by the usual picture of coagulation necrosis involving the subcutaneous and muscular tissues, and in many cases involving the abdominal muscles. The internal organs, especially the liver and lungs, and in one instance the spleen, showed small foci of caseation in which necrosis bacilli were readily observed on microscopic examination.

INOCULATION OF GUINEA PIGS.

Guinea pigs were inoculated with pure cultures of the necrophorus bacilli both by the subcutaneous and intraabdominal methods, but always with negative results. Six animals were used in each experiment and doses ranging from 0.25 to 1 c. c. of a 48-hour bouillon culture injected without producing any untoward effects.

VIRULENCE FOR OTHER ANIMALS.

Among the many conditions in which the bacillus of necrosis has been found as a producer of disease, Francke³ states that it is shown by the writings of Bang that this bacillus is the causative agent of a troublesome foot disease of cattle which, commencing as a phlegmonous inflammation of the soft parts of the foot close to the horn of the hoof, shows a tendency toward necrotic degeneration.

Through the results obtained by Bang after careful research, Francke is enabled to state positively that all of the necrotic and gangrenous

changes found in this affection of cattle are due to the invasion of the bacillus of necrosis following some injury to the foot.

He also quotes Von Imminger as authority for the statement that the bacillus of necrosis is the causative agent in an infectious disease of the feet of cattle which he had studied. Von Imminger reached the conclusion that there could be no doubt of the contagiousness of the disease, and from the nature of the pathological changes always present he concluded that the bacillus of necrosis was probably the active agent in promoting the spread and continuance of the disease. He appears, however, to have made no bacteriological study of these cases.

Through Francke's own investigations he has found that the bacillus of necrosis is very widely distributed by nature, and that it is very actively concerned, either alone or as accessory to some other virulent organism, in the development of a number of spreading diseases among the domestic animals, and that wherever found, its presence is manifested by an erosive local destruction of tissue.

In cattle and horses necrotic areas are sometimes present in lungs or liver, the origin of which is plainly shown by microscopic examination to be the long threadlike bacillus of necrosis.

Ernst,⁴ who has made a careful study of the bacillus of necrosis, states that Bang was the first to recognize the multiplicity of ways in which the pathogenicity of the organism is shown. He described it as the active factor in the production of several diseases which are characterized by more or less necrotic destruction of tissue, in cattle, horses, deer, hogs, sheep, and kangaroo.

In writing of malignant foot-rot in cattle, Hess⁵ maintains that this disease is identical with contagious foot-rot of sheep. In studying the disease as it appears in cattle he has found that it is caused by a micro-organism first described by Loeffler, and by him named "*Bacillus necrophorus*."

Nocard and Leclainche⁶ state that it is permissible to consider that foot-rot of sheep is caused by the bacillus of necrosis, but they, like Hess, fail to present any bacteriological evidence for their assertion.

Horne⁷ has reported a very interesting outbreak of sore feet among the reindeer of Norway from which he has recovered the *Bacillus necrophorus*. This author writes:

It is emphasized that the disease is contagious; it is declared to be highly contagious. The malady appears to be spread by healthy animals walking in the steps of diseased ones, where they catch the infective principle from the ground in small sores or cracks in the skin.

ECONOMIC IMPORTANCE.

Throughout the Middle West, where packing houses are located in many of the largest cities, the sheep-feeding industry has attained

large proportions. At points situated within easy reach of the more important slaughtering centers there have been stations established for the purpose of finishing off those sheep and lambs that have been shipped from the ranges farther west before they had reached a sufficient degree of fatness to admit their being dressed to advantage. The stations are located within easy reach of several of the more important stock yards, thus enabling the owner to take advantage of a favorable turn in market quotations, or to supply any shortage that may occur in the receipts of a particular grade of sheep at the yards with which he is associated.

There are several of these places with a capacity of over 50,000 sheep each, and one near Chicago that can accommodate 80,000, as will be seen by the following list of feeding stations, the total of which shows that 683,000 sheep can be finished for market at one time. This list does not include the vast numbers of animals that are fed in the feeding stations of the far West nor those in bunches of 500 to 3,000 by private individuals throughout the central Northern States.

Partial list of sheep-feeding stations in the United States.

Location.	Capacity.	Location.	Capacity.
Grand Island, Nebr.....	25,000	Piano, Ill.....	25,000
Norfolk, Nebr.....	25,000	Specht, Ill.....	25,000
Nickerson, Kans.....	25,000	Rochelle, Ill.....	20,000
St. Marys, Kans.....	25,000	Milledale, Ill.....	15,000
Hanover, Kans.....	8,000	Oswego, Ill.....	15,000
Columbus, Nebr.....	25,000	South St. Paul, Minn.....	40,000
Valley, Nebr.....	35,000	St. Anthony Park, Minn.....	60,000
Fremont, Nebr.....	25,000	Brighton, Minn.....	25,000
Stockdale, Ill.....	60,000	Trevor, Wis.....	25,000
Lafox, Ill.....	60,000		
Montgomery, Ill.....	80,000		
Kirkland, Ill.....	40,000	Total.....	683,000

It is customary to keep the animals closely penned during the period of their fattening at these establishments; in fact, they are sometimes restricted to rather uncomfortably narrow quarters. They are divided into lots of 200 to 600, to suit the convenience of the feeder, and each lot is provided with a separate pen in which they remain from the time of their arrival until sufficiently finished to warrant the continuance of their journey to the packing house. In many cases their grain is supplied to them through "self-feeders," by which means a supply is kept constantly before them. Water is also available at all times, and the incentive to active exercise is very slight, even if the pen were large enough to allow unrestricted movements. Under these conditions an outbreak of foot-rot quickly assumes serious proportions. While the disease will not of necessity spread from one pen to an adjoining one, there are several cases on record where the contagion has been so thoroughly disseminated among individual pens in which a few infected sheep have been placed that only a small number of its inmates escaped the attack. Inspectors of the Bureau of Animal Industry, United

States Department of Agriculture, occasionally find an affected flock among the arrivals of sheep at the various railway terminals in which the feet of as many as 75 to 80 per cent are diseased to a greater or lesser extent. These bunches of sheep have no doubt been run together in the feeding pens, and the percentage of diseased animals gives one a very good idea of the infectiveness of foot-rot under these conditions.

The sheep raiser or feeder who carries on his business upon a modest scale is often just as seriously injured by an outbreak of foot-rot in his flock as is anyone. His sheep run at will over a large portion of his farm, and it soon becomes so thoroughly contaminated by the repeated passage of diseased feet that the owner not only becomes thoroughly discouraged by the repeated failures of his attempts to eradicate the contagion from the premises, but his neighbors begin to look on him with suspicion, and in certain instances have become so aroused as to warn the unfortunate man against entering upon or crossing their holdings until he has succeeded in stamping out the dreaded plague.

The importer or breeder of choice registered sheep is frequently damaged materially by the appearance of this disease among his valuable animals. Foot-rot occasionally develops in sheep soon after importation from European countries in spite of careful examination at the time of purchase. In these cases it is probable that the virus had become lodged in some deep fissure under the horny covering of the foot during some previous exposure, and that it had remained latent in its hiding place until favoring conditions stimulated its growth. Whatever the manner of propagating the infecting agent, the fact remains that foot-rot frequently manifests itself among flocks of blooded sheep while on shipboard en route to this country, and conditions here favoring the spread of the infection from sheep to sheep, it is not uncommon for the animals of certain pens to show serious lameness by the time the port of debarkation is reached. Another place in which the owner of improved sheep becomes exposed to more or less danger of infection of his best specimens is at the live-stock shows of the country, where his animals are exhibited side by side with sheep from widely scattered localities. This danger, however, is reduced to the minimum by the excellent care given to both animals and pens while the exhibition is in progress. The greatest danger is probably met when the animals are loaded and unloaded over a chute at the railway station, which is used by all of the exhibitors in common.

The raising of Angora goats is also becoming an industry of great economic importance. Their value as producers of mohair, of fleece-bearing skins, and of meat, together with their efficiency as eradicators of brush and weeds, is bringing them into increasing favor with practical American people, while their beautiful silky coats and gentle dispositions make them very attractive as pets for those who seek to

derive pleasure rather than profit from them. At the present time large sums of money are invested in these animals, and individual flocks numbering thousands of animals are not uncommon in some localities. An association of breeders has been formed which supports a registry book, and live-stock exhibitions at which the Angora forms a prominent feature are sure to attract general interest.

The experiments which have been made at this laboratory prove that Angora goats may readily be inoculated with foot-rot from sheep, and that where sheep and goats are allowed to pasture together they may be indiscriminately attacked by an invasion of this disease.

To what degree the prevalence of foot-rot among sheep and goats in this country exists can not be accurately stated, for the reason that our statistics are not sufficiently numerous to furnish a basis for a reasonable estimate. Occasional outbreaks, especially the highly virulent ones, are reported, and in these cases about three-fourths of the flock become affected. Owing to the slow, protracted course of the disease and the length of time required for the affection to pass through a bunch of sheep, the losses occurring from the shrinkage of flesh in market sheep and from the diminution of the supply of milk for the sucking lambs of the affected ewes reach material proportions. In addition to these direct losses, the owner of an infected flock of full-blooded animals is subjected to discouraging failures in his attempts at selling off his surplus breeding stock, as prospective buyers are naturally reluctant to introduce lame animals into their sheep-folds. The time and labor spent in the treatment of the feet of an infected flock should also be brought forward in this calculation of monetary loss.

DIFFERENTIAL DIAGNOSIS.

There are but few pathological conditions of the feet of sheep or goats that may be mistaken for contagious foot-rot. When lameness first makes its appearance in a flock there may be some hesitancy, however, in determining the exact nature of the trouble. Lameness may be primarily caused in these animals by wounds of the feet, by purulent inflammation of the interdigital space (so-called noncontagious foot-rot), by stoppage of the orifice of the biflex canal, by suppurative cellulitis (cutaneous abscesses), or by foot-and-mouth disease, and for a time the lesions produced by any one of these causes may offer a very confusing resemblance to those characteristic of the invading stage of foot-rot.

WOUNDS OF THE FEET.

It occasionally happens that in running over fields or roads where sharp stones abound that sheep or goats will puncture the skin of the interdigital space by forcing one of the sharp edges of a stone between the claws of the foot. This accident is not of frequent occurrence,

and the fever and lameness thus produced seldom last for more than a few days.

Another source of injury to the feet is seen where bushes or coarse weeds have been cut off close to the ground, leaving stiff, dense, pointed stubs standing erect, offering with their firm, sharp ends an enduring menace to the feet of all unwary passers. Another common cause of accidental lesions to the feet of sheep is met in or around their stables, where loose boards, with the projecting points of nails sticking upward from their surfaces, are carelessly left for the flock to run over while passing to and from their shelter.

The foot should be cleansed with a 5 per cent carbolic-acid solution when it has been subjected to an injury which leaves an open sore, and in cases in which the formation of pus ensues, this should be liberated by the use of a clean knife or needle, after which the application of poultice supported by a light soft bandage will be found very beneficial.

PURULENT INFLAMMATION OF THE INTERDIGITAL SPACE (FOULS).

This condition is one that is frequently met in sheep, and it has often been mistakenly called foot-rot. From this faulty naming has arisen much of the controversy over the question of the contagiousness of foot-rot. Parties who have had experience only with purulent inflammation of the foot, and who have looked upon it as foot-rot, have very reasonably asserted that foot-rot is by no means contagious, that it appears sporadically, may attack but few members of the flock, yields promptly to treatment, and nearly always makes its appearance among sheep during their pasturage upon low, swampy land. If the term foot-rot is used at all in connection with purulent inflammation of the feet, it should be qualified by calling the affection benign or noncontagious foot-rot, in order to avoid all confusion with the real or contagious form of the disease. This purulent inflammation may result from pasturing on wet, filthy grounds or on low, marshy lands. An irritation of the cleft of the foot occurs which is followed by fissures in the skin and a softening of the horn resembling foot-rot. In rainy weather sheep that are pasturing upon clay soils often accumulate irritating masses of twigs, stubble, or small, sharp pebbles in the interdigital space of the foot. These substances become thoroughly embedded in moistened clay and this mixture is gradually molded to the form of the space between the claws of the foot. In this position it will remain for days unless removed by force, and it may be the cause of serious inflammation, suppuration, and lameness so long as it retains its position in this sensitive place. Every step of the animal causes the projecting points of the offending material to cut deeper and deeper into the adjoining tissues of the foot. There ensues swelling above the coronet and the whole of this region becomes reddened and feverish. Cases have been noted where marsh grasses with their

saw-like edges have become entangled in the cleft of the foot and have remained in position long enough to set up a painful irritation by their constant friction. Finally, on examining the foot of a lame sheep one may discover the presence of none of these pointed objects, and still the inflammation is intense. This condition has been known to follow the entrance of particles of sand and gravel into the cuts, cracks, or injuries, and one should always bear this in mind while looking for a cause for lameness, and carefully remove the grit or dirt which may be present. Sometimes the horn, having grown rapidly because of the unusual stimulation, may inclose the gravel and retain it within the foot as a constant source of irritation.

Unless these irritating substances have remained in position long enough to cause suppuration, the only treatment required is their removal. If suppuration has become established the antiseptic treatment previously recommended for wounds of the foot will be found to give admirable results.

STOPPAGE OF THE BIFLEX CANAL.

Sheep and goats are provided with a secretory gland called the interungulate or biflex, situated among the tegumentary tissues of the leg just above the separation of the digits. The orifice of the little vessel that leads from this gland may be plainly seen upon spreading the toes apart. The secretion of the interungulate gland is of an oily nature and serves as a lubricant for all tissues in the cleft of the foot that are subjected to friction during the progression of the animal. In the healthy normal foot the functions of this little secretory organ are carried on unnoticed, but it occasionally happens that mud, sand, or some other gritty substance becomes forced up into the biflex canal and lodges there, not only choking up the excretory passage of the gland above, but also causing inflammation of the walls of the canal, which may develop into extensive suppuration and serious lameness.

This affection may be distinguished from contagious foot-rot by the fact that the ulceration does not tend to invade the tissues beneath the horny covering of the foot, nor does it assume an infectious character.

The orifice of the canal should be opened by thorough washing, after which it may be dressed with a poultice held in place by the application of a soft bandage. Should the suppuration have become so deeply seated that it will not yield to washing it may be found necessary to lance the part in order that a passage may be provided for the escape of the imprisoned pus. A knife with a small keen blade should be used in this operation, and it should be carefully cleaned both before and after using. Poultices should always be applied to feet that have required surgical relief, and the bandages ought not to be permanently removed until the wound has healed over, superficially at least, as it

will give valuable assistance to the healing process by keeping dirt from entering the injured areas.

SUPPURATIVE CELLULITIS (CUTANEOUS ABSCESSSES).

Stockmen whose cattle and sheep are obliged to pass daily through muddy yards or pens, especially if the mud is so deep that passage requires laborious wading, sometimes notice the eruption of sores, varying in size from the diameter of a millet seed to that of a silver dollar, upon the lower extremities of animals subjected to such conditions. These sores may appear just above the coronet, farther up in the region of the ankle, or still higher until the skin near the knee becomes the seat of the lesion.

The first indication of the trouble will be an erection of the hair over the affected area, quickly followed by swelling of the part, and accompanied by a marked rise in the body temperature of the animal, loss of appetite, sluggishness, and rapid wasting of condition.

As the disease advances, each of the inflamed areas develops a typical abscess, containing creamy pus with a very offensive odor. At this stage it is sometimes discovered that one or more of these abscesses have become established beneath the coronary band or even beneath the horny wall of the foot, although in the majority of cases the lesions are all confined to areas above the foot, where the leg has a thick hairy covering. Should these find lodgment in the tissues of the foot they may be mistaken at first for indications of contagious foot rot. But the discovery in this region of a circumscribed abscess filled with pus, with the simultaneous appearance of similar abscesses beneath the skin of the leg will at once prove to the owner of the flock that the trouble is an outbreak of cutaneous abscesses and not an attack of contagious foot-rot.

Although this disease yields readily when proper treatment is applied during the early part of its development, it will often terminate fatally if neglected. The skin of the lower part of the leg is comparatively thick and resistant, and in consequence the abscesses seldom open spontaneously, but, spreading to the adjoining subcutaneous tissues, assume an eroding character which permits the absorption of their products by the blood vessels, and general septicemia and death result. Investigations from a bacteriological standpoint, especially those of Moore⁸ and Voges⁹, prove the constant presence of pyogenic streptococci in the abscesses of the skin, and they are undoubtedly the cause of the affection.

In many instances it has been found that the removal of the flock from their muddy surroundings to dry, clean quarters has the desired effect of checking the spread of the disease. More advanced cases demand that the abscesses be opened surgically and thoroughly cleaned with an antiseptic solution, after which rapid healing usually follows.

FOOT-AND-MOUTH DISEASE.

This country, most fortunately, has never experienced a serious outbreak of foot-and-mouth disease in sections in which the sheep industry forms an important factor in agricultural activities. It is one of the scourges of European countries, and the annual reports of outbreaks of contagious diseases in these lands show what a firm footing the disease has gained among their flocks and herds.

Should an invasion of this disease ever be mistaken for foot-rot in sheep, the illusion will not be one of long duration. The eruptions which appear upon the feet of sheep in an attack of foot-and-mouth disease may, during the invasive period of the outbreak, bear a close resemblance to those of foot-rot, but they are more superficial in their effect, being devoid of the deep-seated, erosive passages which characterize the foot-rot lesion, and for this reason they are far more transient, disappearing voluntarily when the disease has run its course in all cases in which the attack reaches a favorable termination. The lesions of foot-and-mouth disease are more plainly to be seen, the destructive processes frequently extending up above the cleft of the foot in front or rear into plain view of the examiner. In uncomplicated cases there is never any tendency to fungoid growths, and the structure of the hoof retains its normal formation and does not become soft or crumbling, as it frequently does after an attack of foot-rot. The primary attack of foot-and-mouth disease is usually evidenced by the simultaneous affection of at least three of the feet of the animal. The infection spreads more rapidly through the flock, and not to the sheep alone, but to the cattle and hogs which are permitted to mingle with them. In addition to the eruptions on the feet the sheep suffering from foot-and-mouth disease will occasionally show reddened patches upon the membranes of mouth and lips which speedily develop into blisters of varying sizes. The tongue may be affected in the same manner. These blisters soon rupture, leaving raw, open sores. The teats and udders of affected ewes are frequently the seat of like eruptions. The temperature of the animal shows marked elevation during the invasion of the trouble (106° F.), but this does not persist after the rupture of the vesicles. Lesions of the mouth are not so constant in sheep as they are in members of the bovine family.

A number of European writers have in the past insisted that contagious foot-rot of sheep does not exist independently of foot-and-mouth disease; but the very fact that contagious foot-rot has for years been more or less prevalent among American sheep without ever having given rise to foot-and-mouth disease among the cattle and hogs of the same farms offers the most conclusive evidence that the diseases are independent one from the other and that they have their origin in separate, specific organisms.

At a gathering of veterinarians held in Saxony an address was given by Martens¹⁰ in which he claimed, in direct opposition to the views held by a majority of his colleagues, that malignant foot-rot of sheep was by no means the same malady as foot-and-mouth disease. In the course of his remarks he said that the malignant foot-rot of sheep has been known in Europe for more than a century and has occurred on many sheep farms throughout all Germany, where it has proved to be a plague which has caused great damage. In some of the flocks it had existed for many years in spite of all attempts at its eradication.

In discussing the similarity of characteristics which exists between foot-and-mouth disease of sheep and contagious foot-rot in the same species of animal, Martens¹¹ says that rapidity of spread of an outbreak among the animals of a flock is not always a certain indication that the disease in question is foot-and-mouth disease, as he has seen over 30 per cent of a flock attacked with foot-rot in the course of a single week during a season of warm, humid, or stormy weather.

PREVENTION.

The prevention of foot-rot, a matter of absorbing interest to the sheep owner, may be successfully attained by means of careful management.

When purchases of sheep are to be added to a healthy flock the buyer can not exercise too great caution in his examination of the newcomers, and holding them for a few days in isolated quarters before permitting them to join the main flock, may prove to be time and effort well spent. Another precaution which will in some cases prove beneficial may be found in the regular examination at stated intervals of the feet of each member of the flock, and the removal of all excessive growths of horn. A large percentage of lameness in the horse is due to an "unbalanced foot," and the first step in treatment should always be the paring of the hoof, or the formation of the shoe in such a manner that the foot of the horse, while he is standing at ease, will be perfectly level in its relation to the floor surface upon which he is standing. The same rule holds good in an application to the ovine race. Overgrown hoofs should be so trimmed that the plantar, or wearing, surface of the foot will present a natural angle to the direction of the bony shaft of the leg, and all superfluous length of toe should be removed. Overgrown toes frequently tend to forcibly spread the hoofs apart, the tension thus produced leading in many cases to strained tendons and to lessening of the natural resistance of the tissues of the region to injury.

A great amount of vital energy is unnecessarily expended in walking by a sheep with overgrown toes, especially if the animal is kept in yards or pens where cornstalks or other coarse litter are allowed to

accumulate, or if it is pastured in stubble fields or where the grass has become long and tangled.

The heels of the hoofs seldom require any cutting, and the labor of trimming may consequently be entirely expended upon the toe. Soaking the feet for a time will be found to soften hoofs that are at first too hard to yield readily to the knife. It will be found satisfactory, where practicable, to select a time for trimming the hoofs when the flock may be brought up to the pens directly from an excursion through wet grass. The early morning following a heavy fall of dew is frequently selected for this purpose, or the work, if not neglected too long, may be deferred until a suitable rainy day.

Should the infection of foot-rot have been introduced into a sheep yard trimming of the feet will not prevent the spread of the disease, except as it indirectly assists nature in keeping the cleft of the foot free from dirt, and the wise shepherd will not relax his vigilance at the time of admitting fresh arrivals upon his premises, as it is at that time that he may most easily prevent the spread of this disastrous malady among his healthy animals.

Experience has shown that sound sheep may be safely pastured on land that has previously been occupied by sheep suffering from foot-rot, provided that a winter's frosts have been allowed to intervene. The contagion of the disease seems to be effectively subdued by this means, and pastures that have become contaminated one season may be considered safe for their customary usage during the following season. The sheepfold, however, must be carefully disinfected to prevent the recurrence of the disease, as this bacillus will retain its virulence under suitable conditions in or around stables for several years. The walls, racks, and troughs should be sprinkled with a solution containing 1 pound of pure carbolic acid to 5 gallons of water, to which enough lime has been added to make the sprayed area conspicuous. The manure and 4 inches of the surface soil should be removed and spread on a field that is to be tilled. In turning sheep on grass care should be taken to avoid low, marshy, or boggy lands, and to keep them, if possible, on high, dry pastures.

TREATMENT.

One of the first steps to be taken in the treatment of a flock of sheep affected with foot-rot is to separate all that are in any degree diseased from those that are healthy. After this has been accomplished much will depend upon the stage which the disease has reached among the animals of the flock in determining upon further action. Should the disease be in its earliest stage, with but few animals affected, it will doubtless be found sufficient treatment for those that appear sound to pass them through a shallow trough containing a solution composed

of 1 pound of chloride of lime to each 12 quarts of water. This solution should have a depth of at least 4 inches in the trough, and the animals should be made to pass through it slowly, allowing time for the mixture to apply itself thoroughly to all the cracks and fissures of the feet. Instead of the mixture of chloride of lime, a solution composed of 1 part of carbolic acid crystals to every 30 parts of water, or 1 pound of pure carbolic acid to 4 gallons of water, may be used as a foot bath for the sound part of the flock.

The trough used in this operation may be of wood, tightly constructed, 20 inches in width, and a foot or more in depth. The length should be proportioned to the size of the flock to be treated. For small lots that are accustomed to being handled, the trough need not be over 6 feet in length. In such cases, however, the animals should be allowed to stand for a moment in the solution before passing out. A greater length of trough would necessitate the preparation of a larger amount of fluid, and consequently would entail greater expense. Where a large number of sheep is to be treated the trough should not be less than 20 feet in length. Hurdles or portable racks may be so arranged by the sides of the trough and along the pathway leading to it that each animal may be obliged to pass through the bath with but very little urging.

After this treatment has been applied to the sound part of the flock, they should be at once placed in fresh, uncontaminated quarters. Although they are not likely to show any evidences of the disease after being treated in this way, the owner or shepherd should not neglect them, but should closely watch for any signs of lameness, and when discovered the affected animals should be promptly removed and subjected to more careful treatment. In case the flock from which the healthy sheep were separated is badly diseased, it would be advisable to have the sound animals pass through the bath as described above on several occasions. This may be done every second day until three or four treatments have been applied, special care being taken in the meantime to provide fresh, clean quarters for the animals, completely separated from the diseased portion of the flock.

While selecting treatment for that portion of the flock in which the disease has become actually established, it should be remembered that the principal requisites are to lay bare the affected surfaces and to destroy the infectious matter which has lodged upon them. The remedy which will accomplish this most readily, and at the same time without giving rise to harmful secondary conditions is evidently the one that should be given the preference.

The bacteria to which the disease is due yield very readily to the application of disinfectants, and the trouble which so many sheep men have experienced in the eradication of foot-rot from their flocks must

have been due to a failure to expose properly the affected surfaces to the action of the applied remedy.

During the present course of experiments many of the feet in which disease had been purposely produced have been healed up as soon as the true course of the affection had become evident, so as to avoid unnecessary lameness; and in these cases it was found that all advancement of the disease processes promptly stopped upon the application of a 5 per cent solution of carbolic acid, a few applications usually proving sufficient. In these cases, however, it must be admitted that the conditions for successfully healing the lesions were far more favorable than those which surround the average diseased flock upon the farm. In the first place, the erosions had not extended very deeply into the foot, and, secondly, the animal was not allowed to run in a muddy yard, but was kept upon a dry stable floor. The instances serve to prove, however, that the remedy need not be very poisonous or caustic to produce the desired results, and to emphasize the fact that one must constantly aim, while treating foot-rot in sheep, to expose the diseased areas to the action of the disinfectant used.

Treatment of the affected animals should not be deferred, as more satisfactory results will be obtained by attacking the outbreak as soon as discovered than can be expected if the disease is permitted to spread among the flock or to penetrate deeper into the tissues of the affected feet. This is accepted as a very practical fact by the English shepherds who attend shipments of thoroughbred sheep on their transatlantic voyage to this country for breeding purposes. The statement is made by them that none but negligent or inexperienced shepherds will ever allow foot-rot to spread through a flock of which they are in charge, as thorough trimming and antiseptic treatment of the hoof of the first animals seen to be lame will surely save the balance of the sheep from an attack.

The treatment already suggested for the sound portion of the flock will be found very efficacious for early stages of the disease, but after the animal has become more seriously affected one should carefully examine each of its feet, and, if necessary, pare away all shredded or loosened portions of the horny tissue. This will often prove to be a very laborious undertaking, but the operator should persist until the loosened horn has been thoroughly removed and all of the ulcerous fissures have been exposed.

The foot must be carefully cleaned and every portion of loosened and detached horn cut away, as the horny tissue once separated from the sensitive parts beneath will never unite with them again, but will remain as a source of pain and inflammation and also a protection for the disease-producing organisms while they attack and destroy the internal structures. Should fungoid granulations be met they should

be removed with a knife or pair of curved scissors. All clippings and trimmings that are removed from the diseased feet, whether composed of bits of horn, shreds of tissue, or fungoid growths, should be carefully gathered up and burned or disinfected, as they may serve to spread the disease further if left where passing sheep may come in contact with them.

If this work has been thoroughly done, standing the sheep for ten minutes in a strong solution of copper sulphate (blue vitriol) made as warm as can be borne by the hand, will in most cases effect a cure. This solution may be prepared by dissolving 4 pounds of copper sulphate in 5 gallons of warm water. The footbath should be repeated if necessary.

An attendant should remain stationed by the side of each sheep whose feet are badly affected to prevent the animal from lying down while it is in the copper-sulphate solution, as sheep of this class, because of the pain produced during their efforts to stand, are liable to drop to their knees or even to lie down in the trough during the application of the treatment. Soft bandages should be applied, after the sheep are removed from the footbath, to all feet that have required deep cutting, not only for the purpose of protecting the sensitive tissue from becoming bruised, but in order that particles of dirt may be kept from the raw surfaces, and that nature may be assisted in the formation of new protective coverings.

It sometimes happens that the disease assumes an aggravated form in several of the sheep, involving the deeper sensitive tissues and necessitating the application of hand dressings to the feet. In such cases all the loose and diseased tissue should be cut away and the affected parts washed thoroughly with a 5 per cent solution of carbolic acid. An antiseptic astringent powder, consisting of 4 parts of carbolic acid, 2 parts of tannic acid, and 94 parts of exsiccated alum, is then dusted upon the ulcerated surfaces, and a bandage applied to afford the parts the desired amount of protection.

The most earnest efforts should be made to conquer the disease before the advent of warm weather, as it will be found more difficult to deal with during the latter period. On the contrary, cold weather and dry seasons are unfavorable for the development or spread of the disease, although they will not cure it.

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STATE STOCK BREEDERS' ASSOCIATIONS.

BY

GEORGE M. ROMMEL, B. S. A.,
Expert in Animal Husbandry, Bureau of Animal Industry.



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(Continued on page 3 of cover.)

U. S. DEPARTMENT OF AGRICULTURE,

BUREAU OF ANIMAL INDUSTRY—Bulletin No. 64.

D. E. SALMON, D. V. M., Chief of Bureau.

STATE STOCK BREEDERS' ASSOCIATIONS.

BY

GEORGE M. ROMMEL, B. S. A.,

Expert in Animal Husbandry, Bureau of Animal Industry.



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LETTER OF TRANSMITTAL

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF ANIMAL INDUSTRY,
Washington, D. C., September 27, 1904.

SIR: I have the honor to transmit the accompanying manuscript entitled "State Stock Breeders' Associations," by Mr. George M. Rommel, expert in animal husbandry in this Bureau, and to recommend that it be published as a bulletin. This matter has been compiled in order to answer satisfactorily the many requests for such information that are received by the Bureau.

Respectfully,

D. E. SALMON,
Chief of Bureau.

Hon. JAMES WILSON,
Secretary.

CONTENTS

	Page.
Educational associations	7
Officers and management	8
Membership	10
Meetings	11
Revenue	12
Abstracts of constitutions	12
Protective associations	23
Abstracts of constitutions	26
Specimen constitutions of live-stock associations	36

STATE STOCK BREEDERS' ASSOCIATIONS.

By GEORGE M. ROMMEL, B. S. A.,

Expert in Animal Husbandry, Bureau of Animal Industry.

The organizations of breeders of domestic animals in the United States are divisible into two general groups—those whose purpose is the advancement of the industry in general, regardless of breed distinctions, and those devoted to the interests of one breed only. These groups, in turn, are each divisible into two classes—the former being made up of those whose purpose is principally educational or mainly protective, the latter being composed of associations of an educational nature and those for the registration of breeding stock.

The former class is devoted solely to the improvement (“amelioration,” as the French stockmen say) of the live stock of the country as a whole. Stockmen bond themselves together and meet annually or semiannually to discuss the conditions of the industry, the problems confronting them, and ways and means to solve these problems. At these meetings experts are often asked to address the associations on scientific, economic, or legislative phases of the industry, and the conventions are rallying places for stockmen and their friends; and beyond doubt they act as a great impetus to progress and improvement. Educational, protective, and strictly economic purposes have been considered in formulating the rules by which these organizations are guided. In the corn belt we find associations whose purpose is simply to hold an annual meeting where various subjects are discussed, and not infrequently they collect statistics relating to the industry and wield more or less power in formulating legislation in their respective States. In the far West and Southwest the most powerful associations of this kind are found. These are especially organized for protective purposes, and the police work which they perform often receives by far the largest share of their attention. The enforcement of the stock laws of their States, the registration of brands, the employment of inspectors and agents of various kinds, and the campaign against cattle rustlers and horse thieves give them ample opportunity for development.

The breed associations form, in a sense, a separate group from those just mentioned. The State organizations are generally established solely for the purpose of advertising special breeds of stock. How-

ever, subjects of general interest are usually discussed at the meetings. Frequently, too, these organizations have records for the registration of pedigrees. This has been especially true in the case of several State sheep breeders' associations. The transition from one of these institutions to a full-fledged pedigree record association of national scope is thus seen to be an easy one. The latter organizations are, one might say, the keystone in the structure of our purebred stock breeding. Their records are developed to a very complete extent, and they represent to the breeder his safeguard against inferior animals, haphazard methods, and mongrel blood. Managed by broad-minded, conscientious, and conservative men, they are of untold value to the animal husbandry of the country.

It is apparent that if all the classes of associations of stockmen were discussed in an adequate manner the subject could not be handled within the scope of an article of reasonable length. For this reason it has seemed advisable to limit the scope of this article to those which are organized for the improvement of live stock in general, regardless of breed distinctions; and this apology is made for the apparent neglect to recognize the importance of the breed and record associations, reserving a discussion of them for a later article.

The general live stock associations, then, may be regarded as educational and protective. Associations like the Pennsylvania, Illinois, and California live stock breeders' associations, the Southern Live Stock Association, the Ohio Horse Breeders' Association, etc., belong to the former class, the Cattle Raisers' Association of Texas and the Northwestern and Montana Stock Growers' Associations to the latter. Regarding the business of their members, we may make another classification and call these organizations general associations composed of breeders of all classes of stock and special class associations composed of the breeders of a particular class of stock. The Pennsylvania, Illinois, California, Western South Dakota, and Montana associations mentioned come under the former head, the Texas and Ohio associations under the latter.

The rules governing these organizations are quite similar, and the points of difference easily noted. The usual forms for the government of legislative bodies have been used in formulating their constitutions. For example, most of them are managed by some sort of an executive committee, composed generally of the officers and three or more additional members chosen by the association. The usual officers are a president, one or more vice-presidents, a secretary, and a treasurer, the two latter offices being often merged with very good results. Money received is usually paid to the secretary and by him to the treasurer when the two offices are separate, and the accounts and records of these officers are usually audited at annual meetings by a committee especially appointed for that purpose. The publication

of a report is always a useful feature. It is generally under the auspices of the secretary, and includes, besides the regular business proceedings, a full report of the meetings held, addresses given, etc. Details, however, are presented in the following pages, the intention here being made to present the characteristic differences peculiar to bodies organized for a special purpose rather than all the details of organization, which will readily occur to one familiar with parliamentary law.

The material from which these notes have been drawn is the constitutions of the different associations, and it is very much to be regretted that a review of all of them can not be presented. The Bureau of Animal Industry requested the secretaries of all such associations in the United States to furnish copies of their constitutions for this purpose, but many failed to respond. Those which were received are discussed in this article. It is probable, however, that the number is sufficiently large to include the necessary features of a State stock breeders' association in any section of the country. The acknowledgments of the Bureau are due those officers who responded to its request.

EDUCATIONAL ASSOCIATIONS.

The majority of the State live stock associations are primarily educational. For example, the object of the California Live Stock Breeders' Association is "to encourage the breeding of purebred live stock, to improve the breeds of domestic animals in California, to secure adequate recognition of our animal industry from the State legislature and public officers, to provide for a comprehensive plan of agricultural education, to collect live-stock statistics and disseminate information respecting the superiority of purebred animals, to hold live-stock conventions, to promote live-stock exhibitions, to enlarge the usefulness of the State fair, and in general to contribute to the importance of California as a live-stock breeding center." The Hawaiian Live Stock Breeders' Association has undertaken the publication of a herdbook in which shall be registered the purebred animals bred upon or imported into the Territory.^a

The Illinois and Kansas associations are organized for "the promotion of the interests of the breeders of live stock" in their respective States. The Louisiana Live Stock Breeders' Association is organized "to increase the excellence and provide for the preservation and dissemination, in their purity, of the different breeds of improved live stock of all kinds."

The Missouri, North Dakota, Ohio, and Oregon associations are educational in purpose, and the constitution of the Ohio association

^a The regulations are unique in that they state that "the herdbook shall contain no plates, engravings, or publications of the records of animals."

states that sanitation is one of its objects of work. The Pennsylvania association recommends expert judges to the fairs of the State whose services may be obtained as needed. These judges are elected at each annual meeting of the association. The same feature is used by the Iowa Corn and Hog Breeders' Association. The constitution of this association provides for a committee of six, one of whom is to be the secretary, which is an examining board. This committee conducts examinations at the June session of the association, when candidates for certificates as expert judges present themselves. The candidate must show "satisfactory proofs of his ability and proper conduct and fitness for the duties of judge." The examinations are the scoring of animals with the score cards of the association. The favorable vote of four members of the examining committee entitles the candidate to a certificate.

The Montana Registered Cattle Breeders' Association embraces a field of activity which can well be emulated by organizations in those sections of the country where animal husbandry is not fully developed. Its objects are—

The improvement of cattle in the herds of the Northwest, the encouragement of better breeding, and the introduction of pure blood into the herds of the State.

To promote and aid county, district, and State exhibits by breeders, where friendly competition will lead not only to improvement among breeders who exhibit, but create interest among cattle breeders generally. * * *

To afford mutual protection and aid to breeders and to promote quarterly, semi-annual, or annual public sales of purebred cattle owned in Montana.

The introduction of purebred animals by means of organized effort to build up native stock is certainly a commendable feature. It has been used quite extensively during the past few years in the Northwest. Associations in the South could copy after those in that section and use their powers to encourage the introduction and use of purebred sires.

Integrity in breeding is a subject which receives all too little attention, and, since horsemen are generally accused of laxity in this respect, it is encouraging to note that the object of the Ohio Horse Breeders' Association, in addition to furthering the horse industry in the State, disseminating information, and instructing its members regarding the most approved methods, is "to protect importers, breeders, and purchasers of such horses against injury resulting from persons wrongfully claiming full-blooded and pedigreed animals and selling the same as such."

OFFICERS AND MANAGEMENT.

The officers of these organizations are usually a president, one or more vice-presidents, a secretary, and a treasurer. The number of vice-presidents is governed by various conditions. The Illinois Live

Stock Breeders' Association has four vice-presidents, who are the presidents of the associations whose affiliation makes up this organization. The Missouri Live Stock Breeders' Association has one vice-president for each breed represented in its membership. The South Dakota Improved Live Stock and Poultry Breeders' Association has five vice-presidents, one for each class of stock—horses, cattle, sheep, hogs, and poultry. The duties of these officers are those that usually devolve on persons in such positions. In Missouri each vice-president is expected to have as his especial charge the advancement of the breed which he represents.

When not in session the affairs of these associations are usually managed by a board of directors or an executive committee. The president and secretary, and often all the officers, are generally ex officio members of the managing body.

In Illinois the executive committee of the Live Stock Breeders' Association is composed of the vice-presidents and secretaries of the affiliated associations. In Kansas there is a board of five directors, who, with the president and the secretary-treasurer, constitute the executive committee. In this State this committee is charged with the preparation of the programme for the annual meetings. In Louisiana the executive committee is composed of one member from each Congressional district and nine from the State at large. A similar provision is found in Minnesota. In Connecticut the Sheep Breeders' Association has eight directors, one from each county. With the officers (president, vice-president, secretary, and treasurer) these constitute a board of managers. In Pennsylvania the executive committee is composed of the officers and five members, one each of the latter representing the interests of breeders of horses, cattle, sheep, and hogs, and one representing poultry, goats, and pet stock. The Pennsylvania association also has committees on legislation and fairs. The legislative committee is made up of five members, and its duty is "to endeavor to secure legislation favorable to the live-stock interests of the State." The committee on fairs consists of three members, and recommends "to all fair associations uniform classifications for live-stock exhibitions; also the single expert-judge system, and the employment of judges indorsed by the association."

In the Montana Registered Cattle Breeders' Association the executive committee practically has entire control over the affairs of the organization.

By far the most important officer in these associations is the secretary, who may at the same time perform the duties of treasurer. This officer is really the executive head of the association and should be permanent. He is generally responsible for the preparation of the programs of the annual meetings, makes all the local arrangements for them, acts as press agent for the association, and edits the proceed-

ings of the annual meetings. He may also compile the State breeders' directory, collect statistics of live stock through his office, keep a directory of animals at stud and for sale, and, as in the case of the Hawaiian association, act as custodian of the herdbook. A capable man in this position can benefit the animal industry of his State to a large extent, and it behooves breeders to make careful selection.

In the Montana Registered Cattle Breeders' Association it is possible for a person not a member of the association to become secretary. All officers, with this exception and the board of directors, are chosen by the association in annual meeting. The board elects the secretary, who "may or may not be a member."

If any officer draws a salary it is usually the secretary, and the amount is generally fixed by the executive committee. The secretary of the Ohio Horse Breeders' Association receives his compensation from certain fees, as hereinafter noted.

The treasurer and sometimes the secretary also are required to give bond, the amount not being stated as a rule, this being settled upon by the executive committee.

The officers and members of the executive committee usually serve one year, or until their successors are elected and qualified. Where it is desirable to have an officer permanently in his position, such as the secretary, this is accomplished by reelection. The directors of the Connecticut Sheep Breeders' Association serve two years.

MEMBERSHIP.

The usual condition for membership is, broadly, that the prospective member be an owner or breeder of live stock. In those sections of the country where there is a rather high degree of improvement of domestic animals it is necessary for active members to be interested in purebred live stock, and in some cases that they be breeders. In localities where there is as yet comparatively little improvement of the native stock the only requirement in this respect is that the applicant for membership own some animals. In the majority of cases citizenship or residence in the State is required. In some instances partnerships and corporations are denied membership. The approval of the executive committee is frequently required, but in many cases this is merely nominal, the payment of the annual fee entitling persons to membership if other qualifications are met. As such organizations stand for honesty and integrity, good citizenship is usually specified. The membership of the Illinois Live Stock Breeders' Association is somewhat peculiar. It is made up of several associations of breeders of special classes of stock, whose membership in turn in the special associations constitutes them members of the general association. Actually, however, the general association takes members without requiring membership in an affiliated association as a prerequisite.

The Pennsylvania association provides for both active and associate members, the latter having no vote. The active members must be breeders of purebred live stock, while the associate members are persons "interested in improved live stock." By denying the voting privilege to associate members, this makes the association a bona fide breeders' organization. In the Ohio Horse Breeders' Association breeders and importers in Ohio may become active members, and "dealers" become subscribing members, having all the rights of active members except those of holding office or voting for officers or upon amendments to the constitution and by-laws.

In associations of this nature it is but natural to expect that the gravity of misrepresenting pedigrees is generally recognized and penalties provided for such offenses. It is usually required that specific charges be presented in such cases to the association through the secretary or the executive committee. A fair trial is given, and, if the defendant is found guilty (generally by a two-thirds vote), expulsion is the usual penalty. The trial may be held, after due notice, by the executive committee or before the entire association. In Hawaii the executive committee can try a member on the charge of misrepresenting pedigrees, or conduct endangering "the good order, welfare, and credit of the association," and a majority vote can convict. If the accused requests, however, this vote must be approved by a majority of the members of the association in regular annual meeting. In the Illinois Swine Breeders' Association the executive committee has the power to examine into a suspicious case and, if the facts warrant, suspend a member suspected of fraud, the entire case to be submitted later to the association. In North Dakota the executive committee may expel a member for "willful misrepresentation or dishonest or unfair dealing in connection with the sale of any registered live stock," a two-thirds vote of the members present being necessary to convict. A similar provision is found in the constitution of several other associations. In the Southern Live Stock Association failure to pay dues within six months of the time when they become payable forfeits membership. In the Iowa Corn and Hog Breeders' Association membership is forfeited if dues or assessments are not paid within thirty days after they become payable.

MEETINGS.

One annual meeting is usually all that is attempted. The place is usually a central one, preferably the State capital, the seat of the agricultural college, or a large market. In some States the location is different each year, the argument being made that by shifting the place of meeting the stockmen of all parts of the State come within the influence of the association. The time of meeting is adjusted so that farm work is not seriously interfered with. The week of the

State fair or of the meeting of the State board of agriculture or the agricultural society is a favorite time.

Special meetings are, of course, provided for in nearly all cases; and ample provision is made, as a rule, for the notification to each member of the time and place of all meetings.

REVENUE.

The income of these associations is usually maintained by membership fees and annual dues. The membership, entrance, or initiation fee is often made to take the place of the annual dues for the first year. The usual fee is \$1 for both membership fee and annual dues. In some cases of special class associations these fees are each 50 cents. In the Montana Registered Cattle Breeders' Association the membership fee and annual dues are \$5. In Hawaii the initiation fee of the Live Stock Breeders' Association is \$25 and the annual dues \$12. In Ohio fees for the privileges of the "Breeders' Record" and the "Sale Record" of the Horse Breeders' Association are the perquisite of the secretary in lieu of salary.

ABSTRACTS OF CONSTITUTIONS.

The following notes show the main features of the constitutions of the associations which responded to the Bureau's circular. By examining them it will readily be seen wherein they differ from each other and from those common to other parliamentary bodies.

GENERAL LIVE STOCK ASSOCIATIONS.

ALABAMA LIVE STOCK ASSOCIATION.

Object.—To encourage the breeding of purebred live stock in Alabama.

Officers and management.—President, secretary, treasurer.

Membership.—New members recommended by a committee and voted upon by the entire body.

Meetings.—Annual; held in different sections of the State each year, so that influence may be as wide as possible.

Revenue.—Annual dues, \$1.

CALIFORNIA LIVE-STOCK BREEDERS' ASSOCIATION.

Object.—To encourage breeding of purebred stock, improve domestic animals, secure favorable legislation, foster agricultural education and the State fair, collect live-stock statistics, hold conventions, promote live-stock exhibitions, and foster the industry in general throughout the State of California.

Officers and management.—President, vice-president, secretary, treasurer, and a board of seven directors, of which the above-named officers are members ex officio.

It is the duty of the secretary "to keep a record of all meetings of the association; to receive all moneys and dues due the association; to pay the same over to the treasurer, taking his receipt therefor; to receive all applications for membership and refer same to the board of directors; to keep a list of members, with their residences, dates of joining, class of stock and families of same; to collect live-stock statistics; and he shall receive such compensation for his services as the board of directors may order."

The board of directors passes upon all applications for membership and has general supervision over the affairs of the association. All officers are elected at the annual meeting and hold offices for one year or until their successors are elected and qualified.

Membership.—Residents of California engaged in improvement of live stock, editors of live-stock and agricultural journals, and experiment station officials "approved by the board of directors."

For "willful misrepresentation of any stock, or acts derogatory to the association," a member may be expelled, a two-thirds vote of members present at an annual meeting being necessary. Secretary notifies offending member of charges thirty days before annual meeting, at which he may appear and receive a hearing.

Meetings.—Annual meeting held at Sacramento on second Tuesday of State fair. Quorum, twenty-five members. Notifications of annual meeting are sent to each member by secretary ten days previous thereto. On request of ten members the president shall call a special meeting. Board of directors meets "at such times and places as may be necessary to transact the business of the association."

Quorum.—Majority of board.

Revenue.—Annual dues are \$3 per member. Members in arrears for one year forfeit membership.

HAWAIIAN LIVE-STOCK BREEDERS' ASSOCIATION.

Object.—The development of the live-stock industry in the Islands.

Officers and management.—President, vice-president, secretary, treasurer, and an executive committee of nine, of which the officers are members ex officio.

In addition to the usual duties of such officer the secretary is the custodian and editor of the herdbook. A record of transfers of animals is kept. The secretary's salary is fixed by the executive committee.

The members of the executive committee must be members of the association interested in the live-stock industry. They are elected at an annual meeting by majority vote, and hold office for one year or until their successors are elected. This committee is empowered "to direct all the affairs of the association." It also passes upon applications for membership.

Membership.—Residents of the Territory owning or breeding live stock or otherwise interested in the industry, who are of good moral character, recommended by three members of the association, receiving the approval of the executive committee, and receiving not more than two negative votes from the association, may become members on payment of entrance fee and one year's dues. Partnerships and corporations may hold memberships. Persons who have rendered valuable services to the industry or to the association may be elected to honorary membership by a unanimous vote of the members present at a regularly called meeting. Members receive a copy of the herdbook free of charge.

Charges of misrepresentation, deception, or fraud in relation to the registration of animals in the herdbook, infraction of the by-laws of the association, or acts prejudicial to its good order, welfare, and credit, are investigated by the executive committee. If founded on fact the offending member is given a fair trial before the executive committee and, if found guilty by a majority of the committee, is expelled from the association. An appeal may be taken to the association at a regular annual meeting, a majority vote being necessary to sustain the action of the executive committee in expelling the offender.

Meetings.—The regular annual meeting of the association is held in October or November, at Honolulu and Hilo, alternately, the president fixing the exact date and place of meeting. The secretary gives thirty days' written notice of the annual meeting to all members. Special meetings may be held as the president may direct, or upon call of the secretary at the request of one-eighth of the members of the asso-

ciation. One-fourth of the members, in person or represented by proxies, constitute a quorum.

The executive committee meets as directed by the president or upon call of the secretary at the request of three of its members. Four members constitute a quorum.

Revenue.—Entrance fee of members, \$25; annual dues, \$12. Fees from herdbook: Registration, to members \$1, to nonmembers \$2; certificate of transfer, if same is reported within six months of date of sale, free to members, to nonmembers 50 cents, if reported after six months from date of sale 50 cents to all; extended pedigrees, \$1. The herdbook as a publication is not a source of revenue. It is supplied to members of the association free, and to other persons at a nominal rate to cover cost of publication and postage.

Miscellaneous.—Herdbook. This association occupies a unique position among organizations of this kind in that it publishes a herdbook, in which may be registered purebred animals of all classes in the Territory. The rules are interesting. The herdbook shall be published at intervals of not less than three years. Applications for entry must be filled out on blanks furnished by the secretary. They must state the sex, color, and markings, date of birth, names, and herdbook numbers of sire and dam, names of owners of sire and dam, name and address of first owner, and signature and address of breeder and owner at the time of making application for entry. Each entry gives the number of the animal recorded, color, sex, date of birth, name and address of breeder and first owner, name and number of sire and dam, and an extension of pedigree if approved by the executive committee. No plates, engravings, or publications of the records of animals may appear in the herdbook. Descent from registered sires and dams is required, or, in the case of animals imported prior to the organization of the association, evidence that the animals were entitled to registration in the country from which they were imported. Transfers must be reported to the secretary. Application for entry or transfer must be accompanied by the prescribed fees.

ILLINOIS LIVE-STOCK BREEDERS' ASSOCIATION.

Object.—Promotion of interests of breeders of live stock in Illinois.

Officers and management.—President, five vice-presidents, secretary, treasurer, and an executive committee of ten. The vice-presidents are the presidents of the affiliated associations, and the members of the executive committee are the vice-presidents and secretaries of these organizations. The officers and members of the executive committee serve one year or until their successors are elected and qualified.

Membership.—Five affiliated State associations of breeders of horses, cattle, sheep, hogs, and poultry.

Meetings.—Annual; time fixed either by association or executive committee.

KANSAS IMPROVED LIVE-STOCK BREEDERS' ASSOCIATION.

Object.—"To promote the interests of the various improved breeds of live stock in Kansas."

Officers and management.—President, vice-president, secretary-treasurer, and a board of five directors, who, with the president and secretary-treasurer, constitute the executive committee. Officers are elected at each annual meeting.

In addition to the customary duties of that officer, the secretary keeps a list of members, their addresses, and class of stock bred by them, which is published in the proceedings of the association.

The executive committee prepares the programs for the annual meetings and furnishes a copy of the same to each member thirty days before the meeting. They "also provide for the publication of the annual reports and have general supervision of the business affairs of the association."

Membership.—"Any person interested in the improved breeds of live stock may become a member" on the payment of the annual fees.

Meetings.—Held annually at Topeka on the second Tuesday in January at 10 o'clock a. m.

Revenue.—Membership fee, \$1, which includes annual dues for the first year; annual dues, \$1.

LOUISIANA STOCK BREEDERS' ASSOCIATION.

Object.—"To increase the excellence and provide for the preservation and dissemination in their purity of the different breeds of improved live stock of all kinds."

Officers and management.—President, five vice-presidents, and an executive committee of 15 members. The executive committee is composed of one member from each Congressional district and nine from the State at large. The officers are elected at each annual meeting and hold office until their successors are elected and qualified.

Membership.—Any citizen of the State interested in the development of its live stock, recommended by the executive committee, may become a member on payment of the entrance fee.

Meetings.—Annual; time and place as directed by executive committee. At a meeting of the executive committee five members constitute a quorum.

Revenue.—Entrance fee, \$1; annual dues, \$1.

Miscellaneous.—The association may divide itself into branch organizations devoted to special classes of stock, holding separate meetings under the auspices and in connection with the general association.

MASSACHUSETTS FARMERS AND CATTLE OWNERS' ASSOCIATION.

Object.—Promotion of the interests of farmers in Massachusetts.

Officers and management.—President, two vice-presidents, secretary, treasurer, and an executive committee of fourteen, one from each county in the State. The officers are members ex officio of the executive committee.

The president determines the exact date of the annual meeting.

Membership.—Persons over twenty years of age engaged in farming or similar occupations may become members by making application to the secretary and paying the prescribed fees. Memberships are annual or life.

Meetings.—The annual meeting is held in January. There may be special meetings. The secretary sends notices of meetings to members at least five days in advance.

Fifteen members constitute a quorum for all meetings of the association; five for those of the executive committee.

Revenue.—Annual dues, \$1; life memberships, \$5, which exempt members from annual dues.

Miscellaneous.—Amendments to the constitution may be made by the majority vote of the members present and voting at any meeting, but notice of the amendment must have been submitted when the call for the meeting was issued.

MISSOURI IMPROVED LIVE STOCK BREEDERS' ASSOCIATION.

Object.—Encouragement of breeding of improved live stock, mutual benefit, and dissemination of information among breeders, farmers, and feeders.

Officers and management.—President, several vice-presidents, secretary, and an executive committee composed of the president, secretary, and three other members.

There is one vice-president for each breed represented in the membership of the association. Each vice-president has as his special charge the interests of the breed which he represents. The secretary is treasurer ex officio.

The executive committee has charge of all the business affairs of the association, selects the time and place for the annual meeting, acts as an auditing committee of

the books and accounts of the secretary-treasurer, arranges the program for the annual meeting, and publishes the same at least four weeks in advance of the meeting. The officers are elected by ballot at each annual meeting and serve until their successors are elected and qualified. The members of the executive committee in addition to the president and secretary are appointed by the president.

Membership.—Application to secretary will enroll persons as members.

Meetings.—Annual, at such times and places as decided upon by executive committee.

Revenue.—No fees or dues unless ordered by majority vote of members present at an annual meeting.

SOUTHERN LIVE STOCK ASSOCIATION.

Object.—To guard and promote the live-stock interests of the South by an organization of the persons engaged in the industry for mutual protection and benefit and to cultivate a more fraternal feeling among stockmen generally.

Officers and management.—President, vice-president, secretary-treasurer, and an executive committee of seven, of which the president and secretary-treasurer are members ex officio.

The secretary-treasurer gives a bond of \$250.

The officers are elected for one year, or until their successors are elected and qualified.

The executive committee has control of all the business of the association except when the same is in session. It has power to appoint inspectors, agents, and representatives and a secretary if necessary. It fixes the salaries of officers and employees of the association. It audits the association's accounts and executes all business within the power of the association. Its action is binding on the association.

Membership.—Any person engaged in raising or dealing in live stock is eligible to membership. Applications are made on blanks furnished by the secretary; the applicant must be recommended by one member in good standing and must accompany his application with an entrance fee of \$1. The application must meet with the approval of the entire association at the succeeding annual meeting.

Failure to pay dues or assessments in whole or in part for six months subjects the delinquent to forfeiture of membership.

Meetings.—Annual meeting of the association on the first Monday in May of each year. The time and place of the next meeting is fixed by the association at this time.

The executive committee meets immediately after appointment and confirmation and holds other meetings on call of the chairman. Three members constitute a quorum, but their action may be rescinded by a two-thirds vote of the entire committee.

NORTH DAKOTA LIVE-STOCK ASSOCIATION.

Object.—Advancement of live-stock interest and improvement of live stock in the State.

Officers and management.—President, first and second vice-presidents, secretary, treasurer, and an executive committee consisting of the officers and four other members.

In addition to the usual duties the secretary publishes the proceedings of the association annually. The treasurer gives a bond in such sum as is named by the executive committee.

"The executive committee is authorized and empowered to conduct the business of the association." It may enact measures and appropriate the funds of the association not to exceed 50 per cent of the amount on hand at any time for any one purpose. The committee can appoint subordinate committees and fill vacancies among the officers. It can also pass upon applications for membership from nonresident breeders.

At each meeting of the executive committee an auditing committee of three is appointed to examine bills against the association and the books of the secretary and treasurer.

Membership.—All farmers and citizens of North Dakota interested in live stock are eligible. Nonresident breeders desiring membership may be elected by vote of the executive committee.

A member "charged with willful misrepresentation or dishonest or unfair dealing in connection with the sale of any registered live stock" is given a hearing before the executive committee, and, if found guilty by a two-thirds vote of the members present, may be expelled from the association. A full report of the trial and findings is made a part of the permanent records and reported at the succeeding annual meeting.

Meetings.—Annual meeting held during January or February as designated by the executive committee, thirty days' notice being given by the secretary.

The president may call special meetings, but in such cases the secretary shall give at least twenty days' notice of their time, place, and purpose.

Revenue.—Entrance fee, \$1; annual dues, \$1.

Miscellaneous.—An auditing committee of three is appointed at each meeting of the executive committee to audit bills against the association and examine the books of the secretary and treasurer. Their report to the secretary is spread upon the records of the association.

OHIO LIVE-STOCK ASSOCIATION.

Object.—Educational, economic, legislative, sanitary; to hold at least one meeting annually, where addresses of an educational nature shall be given by authorities invited by the officers of the association.

Officers and management.—President, vice-president, secretary-treasurer, and an executive committee consisting of the president, secretary-treasurer, and three other members of the association. The officers are elected annually, by ballot or by means of a nominating committee, as the association desires.

The secretary, in addition to the usual duties of such an officer, prepares the programs of the annual meeting, with the approval of the executive committee, and is required to publish its proceedings in pamphlet form. He is also authorized to employ clerical assistance.

The executive committee is an advisory board and issues the call for the annual meeting. Its three members, in addition to the two officers, are elected annually and represent different classes of stock.

Membership.—Reputable citizens of Ohio may become members on payment of the annual dues. Honorary memberships may be voted by the association. Such memberships hold for three years, but may be continued by the association.

Meetings.—Annual, generally in January.

Revenue.—Annual dues, 50 cents.

OREGON LIVE-STOCK BREEDERS' ASSOCIATION.

Object.—Social, educational, economic, sanitary.

Officers and management.—President, vice-president, secretary, and treasurer, who constitute the executive committee.

The executive committee has the general management of the association under the authority of the association.

Officers are elected by ballot at the annual meeting and hold office for one year or until their successors are elected and qualified.

Membership.—All persons interested in breeding and raising live stock may become members on payment of the annual dues.

Meetings.—Annual.

PENNSYLVANIA LIVE-STOCK BREEDERS' ASSOCIATION.

Object.—To encourage and advance the live-stock interests of Pennsylvania.

Officers and management.—President, two vice-presidents, secretary, and treasurer, who, with five additional members, constitute the executive committee. These five additional members represent the interests of breeders of horses, cattle, sheep, hogs, poultry, goats, and pet stock. There is a legislative committee of five members, a committee of three on fairs, and a committee of five on transportation. Expert judges are elected at each annual meeting and recommended to the fair associations of the State.

All officers are elected annually.

The legislative committee endeavors "to secure legislation favorable to the live-stock interests of the State."

The committee on fairs recommends "to all fair associations uniform classifications for live-stock exhibitions;" also the single-judge system and the employment of the judges indorsed by the association.

The committee on transportation attends "to all matters relating to passenger and live-stock transportation."

An auditing committee is appointed by the president at each annual meeting.

Membership.—Reputable breeders of purebred live stock in Pennsylvania may become active members on payment of the annual dues.

Persons interested in improved stock and in sympathy with the association may become associate members on payment of the annual dues. They are not allowed to vote.

Meetings.—Held annually, beginning on Wednesday of the second week in December. The use of proxies is not permitted.

Revenue.—Annual dues, \$1, payable on or before the date of the annual meeting.

SOUTH DAKOTA IMPROVED LIVE-STOCK AND POULTRY BREEDERS' ASSOCIATION.

Object.—"To promote the interests of all classes of pure-blooded live stock and poultry in the State."

Officers and management.—President, five vice-presidents, and secretary-treasurer, who constitute the board of directors. The board of directors decides the date and place of the annual meeting, has power to try a member accused of misrepresentation of pedigrees or other misconduct, and is the governing body of the association. It may appoint subcommittees when necessary.

The vice-presidents represent different classes of stock.

In addition to the usual duties of that officer, the secretary-treasurer publishes a directory of the breeders who are members of the association.

At each annual meeting the president appoints an auditing committee of three to examine the books and reports of the secretary-treasurer.

The officers are elected at an annual meeting and serve for one year or until their successors are elected.

Membership.—No qualifications except payment of an entrance fee and the annual dues after the 1st of January succeeding the date of joining the association.

A member charged with "willful misrepresentation or dishonest or unfair dealing in connection with the sale of registered live stock or poultry" is given a fair trial before the board of directors, and may be expelled if a majority of its members vote "guilty."

Meetings.—Annual.

Revenue.—Entrance fee, \$1; annual dues, \$1.

SPECIAL CLASS ASSOCIATIONS.

CONNECTICUT SHEEP BREEDERS' ASSOCIATION.

Object.—Encouragement of sheep and Angora goat industry in Connecticut, improvement of breeds, and securing legislation favorable to these industries.

Officers and management.—President, vice-president, secretary, and treasurer, to be elected annually. Eight directors, one from each county, four elected annually by rotation, to serve two years each. The president, vice-president, treasurer, and directors constitute the board of managers.

The secretary is appointed annually by the board of managers. In addition to the usual duties of that officer, he receives the fees of members, paying them over to the treasurer, taking his receipt, issues the call for the meetings, and collects information.

Except when the association is in session its affairs are conducted by the board of managers. The board may call special meetings for business or other purposes at their discretion, may present or amend by-laws for the guidance of the association, and elects the secretary. Amendments to the constitution, however, can be made only by the association as a whole.

At the annual meeting of the association an auditing committee of two is appointed by the president to examine the books of the secretary and treasurer.

Membership.—Qualifications not specifically stated.

Meetings.—The association holds an annual meeting at a time and place designated by the board of managers. Special meetings may be called by the board of managers or on call of the president and secretary at the request of ten members.

Seven days' notice of all meetings is given members by the secretary.

The board of managers meets semiannually on the third Wednesday of March and September, in Hartford, unless otherwise ordered. Special meetings may be called by the president and secretary at the request of three members of the board.

Four members of the board of managers constitute a quorum.

Revenue.—Annual dues, 50 cents.

ILLINOIS HORSE BREEDERS' ASSOCIATION.

Object.—To hold annual meetings for the discussion of the breeding, handling, and marketing of horses and the general welfare of the industry.

Officers and management.—President, vice-president, secretary, and treasurer. These officers, with five additional members, constitute the executive committee.

The executive committee conducts the affairs of the association during the interval between annual meetings and passes upon questions of membership and expulsion.

Membership.—Reputable citizens of Illinois engaged in the horse industry.

Meetings.—Annual meetings held at such times and places as are designated by the executive committee. Thirty days' notice is given members.

The executive committee meets on call of four or more of its members; a majority of the committee constitutes a quorum.

Revenue.—Membership fee, \$1, which covers the first year's dues; annual dues thereafter, \$1.

ILLINOIS CATTLE BREEDERS' ASSOCIATION.

Object.—Improvement of cattle industry in Illinois.

Officers and management.—President, vice-president, secretary, and treasurer, which officers, with three additional members, constitute the executive committee.

In addition to the usual duties of that officer, the secretary is empowered to print the proceedings of the association annually.

Membership.—Reputable citizens of Illinois engaged in the cattle industry.

Meetings.—Annual.

Revenue.—Membership fee, \$1; annual dues, \$1.

ILLINOIS SWINE BREEDERS' ASSOCIATION.

Object.—To hold an annual meeting for the discussion of subjects relating to the breeding and feeding of swine and the holding of exhibitions.

Officers and management.—President, vice-president, secretary, and treasurer, which officers, with five additional members, constitute the executive committee.

The officers hold office for one year or until their successors are elected and qualified.

The members of the executive committee are elected by ballot at the annual meeting. This committee has power to manage the affairs of the association during the intervals between annual meetings, select the time and place for the annual meeting, fill vacancies among the offices in the interim, pass upon applicants for membership, and suspend members charged with fraud, if the facts justify such action.

Membership.—Reputable citizens of Illinois engaged in the swine industry and approved by the executive committee.

If a member is charged with willful misrepresentation of any animal owned or bred by him, or with an act derogatory to the standing of the association, the executive committee examines into the charges and suspends the offending member if there is sufficient evidence against him. The case is presented to the entire association at the next annual meeting, and if two-thirds of the members vote guilty the offender is expelled from the association.

Meetings.—Time and place of annual meeting selected by executive committee, thirty days' notice being given members. Members may vote by proxy.

The executive committee meets on the call of four members. A majority of the whole committee constitutes a quorum.

Revenue.—Annual dues, \$1.

ILLINOIS SHEEP BREEDERS' ASSOCIATION.

Object.—Improvement of sheep industry in Illinois.

Officers and management.—President, vice-president, secretary, treasurer, and an executive committee of seven, including the officers.

Membership.—Reputable citizens of Illinois interested in the sheep industry.

Meetings.—Annual.

Revenue.—Membership fee, \$1; annual dues, \$1.

IOWA CORN AND HOG BREEDERS' ASSOCIATION.

Object.—"To promote the general interest of the swine breeders of the State of Iowa, and to improve and perfect, by the use of the score card and standard of excellence of each breed, the system of judging swine," and the improvement of corn in the State.

Officers and management.—President, two vice-presidents, secretary, treasurer, and an executive committee composed of the president, the secretary, and three other members elected by the association.

The executive committee has power to make assessments, no assessment to exceed the admission fee for one year. It also selects the date of the June meeting.

All officers serve for one year or until their successors are elected and qualified.

The association has a standing committee of five, who, with the secretary, constitute a committee on instruction for the examination of persons desiring to qualify as expert judges of swine. The committee examines the candidates by the use of the score cards of the association applied to the actual scoring of animals on foot. The favorable report of four members of the examining committee must be obtained before an applicant is recommended for a certificate.

Membership.—Any breeder of hogs may become a member on payment of the entrance fee. Honorary members may be elected by a two-thirds vote of the members present at the fall meeting.

Failure to pay assessments or dues within thirty days after notice forfeits membership.

Meetings.—Two meetings are held annually at Des Moines, one on Wednesday of State fair week, at which officers and members of the executive committee are elected and matters of interest to exhibitors of hogs discussed; the other between the 1st and 15th of June, when the members of the committee on instruction are selected, candidates for certificates examined, and general business conducted.

Revenue.—Admission fee, \$1; annual dues, 25 cents; assessments by executive committee not to exceed \$1 per year.

MINNESOTA SHEEP BREEDERS' ASSOCIATION.

Object.—To advance sheep husbandry in Minnesota.

Officers and management.—President, vice-president, secretary-treasurer, and an executive committee of seven members.

The secretary publishes the proceedings of each annual meeting and mails a copy to each member of the association.

The executive committee has general supervision over the affairs of the association, has power to fill vacancies among the officers as they occur, and may try and expel, if guilty, a member charged with fraud.

Previous to each annual meeting the president appoints an auditing committee of two to examine the books and accounts of the association and report at the annual meeting.

Membership.—Citizens of Minnesota interested in sheep husbandry.

A member accused of "willful misrepresentation or dishonest or unfair dealing in connection with sheep husbandry" is tried by the executive committee and expelled if found guilty by two-thirds of the members present.

Meetings.—Annual meeting held on the second day of the annual meeting of the State agricultural society at St. Paul, the exact time and place being decided by the president.

Special meetings may be called by the president, but in such case the secretary must give the members thirty days' notice, stating the time, place, and purpose of the meeting.

Revenue.—Membership fee, 50 cents; annual dues, 50 cents.

Miscellaneous.—The constitution requires that amendments to the constitution and by-laws must be submitted in writing to the secretary, who makes copies and sends one to each member thirty days before the annual meeting at which action thereon is to be taken.

MINNESOTA SWINE BREEDERS' ASSOCIATION.

Object.—Improvement of swine industry in Minnesota.

Officers and management.—President, vice-president, secretary, treasurer, and an executive committee of seven members, one from each Congressional district in the State.

The secretary publishes annually the proceedings of the annual meeting and sends a copy to each member.

The treasurer is required to give bond, before entering on the duties of his office, in such sum as may be named by the executive committee.

The executive committee exercises a general supervision over the affairs of the association, appoints subordinate committees, fills vacancies among the officers, and tries members accused of fraud.

Officers and members of the executive committee are elected by ballot at the annual meeting.

The books and accounts of the association are audited at each annual meeting by a committee of three appointed by the president before the meeting.

Membership.—Reputable citizens of Minnesota interested in live stock.

A member "charged with willful misrepresentation or dishonest or unfair dealing" may be tried by the executive committee and, if found guilty by two-thirds of the members present, expelled from the association.

Meetings.—Annual meeting held at St. Paul at 8 p. m. on the day of the meeting of the State agricultural society. The exact place is designated by the president, which officer also gives notice of the time and place of the meeting thirty days in advance thereof.

Special meetings may be called by the president, but thirty days' notice of the time, place, and purpose shall be given by the secretary.

Revenue.—Membership fee, including annual dues for the first year, 50 cents; annual dues, 50 cents.

Miscellaneous.—Amendments to the constitution and by-laws must be submitted in writing to the secretary and copies made and sent to each member by that officer at least thirty days before the annual meeting at which they are to be acted upon.

MONTANA REGISTERED CATTLE BREEDERS' ASSOCIATION.

Object.—Improvement of cattle in the Northwest, the encouragement of better breeding, the introduction of purebred stock into the State, the promotion of county, State, and district exhibitions of live stock, mutual protection of breeders, the promotion of sales of purebred cattle, and the detection of fraud.

Officers and management.—President, vice-president, secretary, treasurer, and a board of five directors. The secretary may not be a member of the association.

The secretary is not permitted to buy or sell cattle on commission nor to be interested in the sale of cattle by others except as the board of directors permits.

Both the secretary and treasurer are required to give bond, the amount being fixed by the board of directors.

The board of directors numbers five and is elected at the annual meeting of the association. The board has charge of all the business and property of the association and may employ assistance to carry on the work of the association. It exercises a general supervision over the welfare of the purebred cattle interests of the State and may expel members for fraud and misconduct.

The officers and directors receive their necessary expenses incurred in the conduct of the business of the association, but no compensation for their services.

Membership.—Membership may be personal, by firms, or corporations. To become members persons must be reputable owners of purebred cattle residing in Montana and approved by the board of directors, of which approval the applicant is notified by the secretary.

Any member who is deemed "guilty of a violation of the rules of the association, or who may be deemed guilty of any act that will tend to injure the interests of purebred cattle or the breeders thereof," may be expelled by the board of directors after a fair trial.

Meetings.—Annual, the time and place being decided by the board of directors. The board selects a date and place at least thirty days in advance of the meeting and notifies the secretary, who in turn must notify all members of the association within ten days of the receipt of notice from the board.

No member may vote at an annual meeting if his membership fee is unpaid.

The board of directors holds an annual meeting immediately after the annual meeting of the association, a majority of the board deciding upon the place of meeting. Special meetings of the board may be held at the request of a majority of the association, a majority of the board, or at the call of the president. A majority of the board constitutes a quorum. In case a special meeting is called the members of the board are given sufficient notice to enable them to reach the place of meeting conveniently.

Revenue.—Initiation fee, \$5, which is also the annual membership fee.

Miscellaneous.—The constitution of this association urges its members to extend by all legitimate means the use of purebred cattle in Montana, to check fraud in the sale of such animals, both among its own members and among those of recognized purebred record associations.

OHIO HORSE BREEDERS' ASSOCIATION.

Object.—To promote the horse industry in Ohio, to protect importers, breeders, and purchasers against fraud, to educate the public engaged in the horse business, and to benefit the members of the association.

Officers and management.—President, vice-president, secretary, treasurer, and an executive committee of five, of which the president and secretary are members ex officio.

The president and secretary prepare the programs for the annual meetings and designate the dates of the regular meetings.

In addition to the usual duties of that officer, the secretary publishes the proceedings of the association and is the custodian of the "Breeders' Record" and the "Sale Record." His salary is obtained from fees for registration of stock in these records.

Officers are elected at the January meetings.

Membership.—Reputable persons residing in Ohio and engaged in the importation or breeding of horses may, upon recommendation of one member of the association in good standing, become active members of the association upon payment of a fee of \$1 to the secretary. Residents of Ohio who are dealers in horses, although not breeders or importers, may become subscribing members when recommended by a member in good standing. Subscribing members have all the rights and privileges of active members except holding office or voting for officers or upon the adoption of amendments to the constitution and by-laws.

Meetings.—Two meetings annually, in Columbus, one in January and the other during the State fair on the day preceeding the opening of the annual convention of the State board of agriculture.

Special meetings may also be held.

Meetings are subject to the call of the president, which is issued to the members through the secretary.

Revenue.—Annual dues, \$1; registration of horses in the "Breeders' Record" or the "Sale Record," 25 cents per head in each record; inspection of these records by nonmembers, 50 cents; registration of sale of animals, 25 cents each.

Miscellaneous.—Registration of horses in the "Breeders' Record" or "Sale Record" is open only to members of the association.

Registration in the "Breeders' Record" shows the name and address of the owner and the name, age, sex, breed, description, and registry number of the animal. If not registered, but eligible, the book in which the animal is eligible to registry is stated and the reasons for claiming eligibility. If desired, the service fees of stallions are inserted.

Horses registered in the "Sale Record" may show the following data: Name and address of owner, name, age, sex, breed, price, and terms of sale.

Only members are allowed the privilege of registration, and the records are open to their inspection at any time. Prospective breeders and purchasers may be allowed the privilege of inspection by paying the prescribed fee.

PROTECTIVE ASSOCIATIONS.

The protective stock breeders' associations are nearly all located west of the one hundredth meridian of longitude, in that section of the country generally termed "the range." They differ in their objects from those which are purely educational, and they are generally more highly organized.

Object.—While many, if not all, combine the educational feature to a certain extent, holding annual meetings at which subjects concerning the industry are presented and discussed from an educational standpoint, the prime motives for their existence is the capture, prosecution, and punishment of stock thieves, the return of strays, mutual protection against common enemies, the enactment of judicious legislation, and the prevention and extermination of disease. The fight

against thieves has been energetically carried on ever since organizations appeared in the range country, and it is still maintained. Other branches of effort are no less vigorously prosecuted. Not only are members severely punished for criminal acts of this character, but the energies of the association are extended much further and offenders are brought into custody largely through the detective work of association members and officials. In Texas members under arrest for stealing are suspended pending trial, and members going bail for a person accused of stealing or other offenses of a similar nature, not members of the association, may be expelled.

The offenses mentioned for which expulsion is the penalty are "stealing, taking, and driving away" from the rightful owner, "marking, branding, killing, driving, milking, or in any way using or appropriating any cattle" belonging to another without the consent of the owner. The Southeastern Stock Growers' Association^a includes "cutting fences or firing ranges or altering the brands of others."

The classes of stock which are protected depend upon local conditions. Barring the sheep and wool growers' associations, the sheep breeder is usually left to take care of himself, and generally hogs are not mentioned. The Southeastern, however, includes this class, and the Northwestern Stock Growers' Association extends protection to the sheep raiser.

The associations of sheep breeders and wool growers have for their primary object the protection of the industry against the hostility of the cattlemen. The Utah Wool Growers' Association carries this to such an extent that provisions are made in its constitution for the support of its members in litigation by the funds of the association.

Sanitary work is frequently a prominent feature. Inspectors are employed in cooperation with the State live stock and sanitary boards to assist in the extermination of disease.

Officers and management.—The executive conduct of protective associations does not differ materially from the purely educational ones, except that it is more systematically organized. The Colorado Cattle and Horse Growers' Association divides the State into ten districts, and each district is given one representative on the executive committee, the secretary being a member of the committee at large and the other officers representatives ex officio of their respective districts. The number of members of this committee varies from five in the case of the North Montana Wool Growers' Association to a possible seventy-five in the Montana Stock Growers' Association.

In the Montana Stock Growers' and the Arizona associations repre-

^aThis association is an organization of the stockmen of Florida, Georgia, and Alabama along the lines of the range associations. Its first meeting was held in Jacksonville, Fla., March 22 and 23, 1904. It will be interesting to note the results of Western methods applied under conditions in the Southeast.

sentation on the executive committee is by counties, in addition to the officers. In Montana provision is made for representation of districts outside the boundaries of the State.

The Utah Wool Growers' Association has, in addition to the official vice-president, one vice-president from each county in the State.

The secretary, or secretary-treasurer when the two offices are combined, keeps an official record of the names and addresses of the members, the officers of companies in which they hold stock, or the members of firms in which they are partners. He keeps a complete record of the brands and marks used by members and generally the number of stock owned by each, and is in close touch with all phases of the live-stock industry in the State.

The term of office is usually one year, and both officers and members of the executive committee are generally elected by the association. In Texas, however, the executive committee of the Cattle Raisers' Association is appointed by the president and confirmed by the association, provision being made against its becoming a permanent body, by a requirement that at least four members be retired annually. Officers may be reelected, but in this association the same person can not hold the office of president or vice-president more than two terms in succession.

Committees on membership and arbitration are frequently provided for.

Membership.—Membership in the association is usually confined to persons owning or controlling stock within the State. In Texas and Oklahoma applicants must be eighteen years of age, and in the Oklahoma Live Stock Association they must control or own at least twenty-five head of cattle.

Applicants must be recommended by one or more members of the association or of the executive committee, must deposit a stipulated entrance fee at the time of making application, and often must be approved both by a membership committee and the executive committee before their applications are voted upon by the association.

Persons becoming members are required to exercise vigilance in the detection of thieves and miscreants, and bind themselves and their employees to maintain good order. Reprehensible conduct is severely punished, and in some associations the arrest of a member for stealing stock or committing acts detrimental to the welfare of the industry is ground for suspension by the executive committee. Stealing, driving away of stock, altering brands, etc., is punished by expulsion. A majority vote of guilty is generally required. Divulging the proceedings of the association is punished by expulsion in many cases. In the Texas association there are three grades of punishment—expulsion, suspension, and reprehension—the jury first deciding the guilt of the accused and afterwards fixing the punishment. The accused

may, however, appeal to the association. In this organization the executive committee acts as jury; charges are first presented to the executive committee and investigated before trial is ordered. If the committee does not deem the charges sufficient, the person bringing them before it may present them to the association for its action.

Meetings.—Regular meetings of the associations are generally held annually at a stated place and time. There may be special meetings as necessary, and the executive committee meets as necessity requires or at stated times.

Revenue.—The revenue of these associations is necessarily quite large. The entrance fees vary from \$1 to \$10 and the annual dues from \$1 to \$5. There are also provisions for assessments on the basis of the stock owned by the members. This is based finally on the county assessors' returns, these being used as a check on the returns made by the members to the secretary. The maximum rate varies from 1 cent per head on 70 per cent of all stock owned by members in the case of the Montana association to 2½ cents per head in the Nebraska association and 3 cents per head on cattle in the western South Dakota association. Sheep are assessed either per head or per 1,000, the rate of the Northwestern association being 2 mills per head and that of the Utah wool growers' \$1 per 1,000 head. The Colorado Cattle and Horse Growers' Association assesses lamb feeders at the rate of 2 cents for each 8 head of lambs. This organization also receives about \$30,000 annually from a State tax levy.

ABSTRACTS OF CONSTITUTIONS.

The following abstracts show in detail for several organizations the general facts presented in the foregoing discussion:

COLORADO CATTLE AND HORSE GROWERS' ASSOCIATION.

Object.—The protection and promotion of the interests of the cattle and horse growers and sheep feeders of Colorado, the enforcement of the live-stock laws of the State, and the "best possible protection for the live stock owned by its members."

Officers and management.—President, vice-president, secretary, treasurer, an executive committee of 11, and a board of control of 3. The president, vice-president, and treasurer are members ex officio of the executive committee from the district of the State in which they reside or hold membership in local affiliated associations. The secretary is ex officio a member of the executive committee from the State at large; he is also ex officio 1 of the 3 members of the board of control.

The secretary has power to contract for material and necessary services. His request for such, countersigned by the president, is an order on the treasurer.

The executive committee has all the powers of general management of the association not otherwise delegated. It makes assessments, may redistrict the State, decides to which district each local affiliated association should be assigned, fixes the time and place for the annual convention of the association, and fills vacancies occurring among the officers. The individual members have supervision of the affairs of the association in the districts which they represent and are consulted by the secretary on all matters pertaining to their districts.

The board of control may call meetings of the entire executive committee and acts for it "in ordinary matters." It is responsible to that body.

The officers are elected by the delegates to the annual convention and serve for one year or until their successors are elected and qualified. Members of the executive committee also serve one year.

The manner of selecting members of the executive committee is somewhat complicated. The State is divided into ten executive districts, along natural geographical lines, and each district is entitled to one representative on the executive committee. Delegates to the annual meeting are chosen by the local affiliated associations on the basis of 1 delegate for each 10 members of such local association, or fraction thereof over 5, and 1 additional "for each 2,000 head of stock or fraction thereof over 1,000, reported for assessment at the last assessment previous to said meeting" by members of the local association. In making this ratio cattle and horses are used as the basis, and the number of sheep equivalent to horses or cattle estimated in the proportion of 8 head of sheep to 1 of horses or cattle. When the annual convention meets the delegates from each district meet in caucus under the rules governing the entire convention and nominate one of their number to represent the district on the executive committee. These nominations are indorsed by the convention. If the delegates from any district can not agree on a member of the executive committee, the convention elects him. However, those districts in which the president, vice-president, and treasurer reside or hold membership do not choose a member of the executive committee, the election to one of these offices carrying with it the election to the executive committee. As the nominees in caucus of members of the executive committee are not presented to the convention until after the annual election of officers, no confusion results from this arrangement.

The board of control is chosen annually by the executive committee from among its members at its first meeting.

At each annual convention the president appoints a committee of three delegates to audit the books of the secretary and treasurer.

Membership.—Composed of twenty-nine local associations of cattle and horse growers in Colorado and the Fort Collins and Weld County Sheep Feeders' Association. Other associations whose members are engaged strictly in feeding sheep or lambs for market may become members, but those composed of persons "running sheep on the public range" are barred.

Application for membership must be accompanied with the initiation fee of \$10, and assessments must be paid up to maintain membership in good standing.

Members of the local associations are regarded as members of the general association and entitled to its benefits and privileges unless the local associations are in arrears in dues or assessments.

Meetings.—Annual convention under the regulations specified above.

Revenue.—Initiation fee, \$10 for each local association, payable on application for membership. Assessments levied as follows: On January 1 of each year the general secretary calls upon the secretaries of local associations to report the number of cattle, horses, and lambs owned by its members, which information must be returned not later than March 1 following. The executive committee assesses the local associations at a rate not to exceed 2 cents per head for cattle and horses and 2 cents for each eight lambs represented by the local memberships.

A State tax levy, yielding about \$30,000 annually.

SOUTHEASTERN STOCK GROWERS' ASSOCIATION.

This association has a constitution organized along the lines of that group of range associations of which the Montana Stock Growers' Association is typical.^a The

^a It will be noticed, however, that it contains many educational features which are lacking in the range associations.

reader should refer to the discussion of the latter and note the exceptions. Among these are the following:

Object.—"To advance the interests of the stock growers of the Southeast, and for the protection of the same against fraud and swindlers, and to prevent the stealing, taking, and driving away of cattle, sheep, hogs, horses, mules, and asses from the rightful owners thereof; to assist in the enactment of just laws for stock breeders, and to encourage the improvement of stock by the introduction of the best breeds, and to inculcate correct principles of breeding, the promotion of closer mutual acquaintance and more friendly intercourse among ourselves and those who may hereafter become parties hereto, and to enforce the stock laws of Florida and the adjoining States."

Officers and management.—Three vice-presidents, one each from Florida, Georgia, and Alabama. The offices of secretary and treasurer are separate, and the executive committee numbers fifteen.

Any of the vice-presidents may act as president in the absence of that officer.

No officers are bonded, none receive compensation, and there is no provision for them to employ assistance.

There are no provisions for the representation of new counties on the executive committee.

There is no committee on resolutions.

Membership.—"All persons who are interested in the breeding and raising of live stock" may become members. It is not necessary to have applicants vouched for. The application is referred to a membership committee of three members of the association and the secretary. If their action is favorable, it is referred to the executive committee, whose action is final.

Information regarding number of stock owned or controlled by applicants, names of members of firms and officers of companies, etc., is not required in this association.

"Cutting fences, or firing ranges, or altering the brands of others" are included among the offenses of which members are required to notify the executive committee for investigation and subsequent prosecution.

Meetings.—The annual meeting is held on the second Tuesday in November at 1 o'clock p. m.

Eleven members constitute a quorum of the association at all meetings; a quorum of the executive committee is three members, of which one must always be the secretary.

Revenue.—Admission fee, \$1; annual dues, \$5. No assessments.

MONTANA STOCK GROWERS' ASSOCIATION.

Object.—"To advance the interests of the stock growers of Montana and adjoining States and Territories, and for the protection of the same against fraud and swindlers, and to prevent the stealing, taking, and driving away of cattle, horses, mules, and asses from the rightful owners thereof, and to enforce the stock laws of the State of Montana."

Officers and management.—President, two vice-presidents, a secretary-treasurer, and an executive committee, of which the officers are members ex officio. There are seventy-one members of the executive committee, elected by counties, according to a prescribed allotment, and including one each from Wyoming, South Dakota, North Dakota, and the Northwest Territory. The county representation in Montana ranges from one to five members each, and representation from new counties, as they are created, is provided for.

In the absence of the president the first vice-president performs his duties; and if both are absent, the second vice-president presides. If all these officers are absent, a president pro tempore is elected.

In addition to the usual duties of the office, the secretary-treasurer keeps a record of brands and collects other information as it may be furnished by the members.

He is also secretary of the executive committee. He is required to give bond with sureties, as the executive committee may determine, and his salary is fixed by that body. He is empowered to employ necessary assistance.

The executive committee exercises general supervision and, during its adjournment, has full control of the association. It audits accounts, represents the association before county and State authorities, fills vacancies among the offices and in its own body, and prosecutes persons engaged in stock killing or stealing, and makes an annual report to the association. Each member is expected to keep in touch with live-stock matters in his immediate locality and gives attention to the affairs of the association in that section. Persons appointed to vacancies hold their positions until the succeeding annual meeting.

At each meeting of the association the chair appoints a resolution committee of five, to whom are referred without debate all resolutions offered on the floor of the convention, except those that come from the executive committee or the State live-stock board.

There is also a standing committee on membership, composed of three members of the executive committee and the secretary-treasurer. All applications for membership are referred to this committee.

Officers and members of the executive committee are elected on the first day of the annual meeting and serve for one year or until their successors are elected and qualified.

Membership.—Only stock growers may become members. This term is defined as "a person owning or controlling cattle, horses, mules, or asses, and engaged in the business of breeding, growing, and raising the same for profit." Memberships must be personal, and the applicant must be proposed by a member of the association, must accompany his application with the fee of admission and a statement of the number of stock owned or controlled by him or by his firm or company, with their brands or marks, and the names of the members of his firm or the names and addresses of all the officers of his company. The application is referred to the membership committee, whose action is final.

Persons becoming members bind themselves and their employees to observe the by-laws, resolutions, and regulations of the association under penalty of forfeiture of membership. Members are expected to notify the executive committee of cases of killing or stealing stock within their knowledge.

Failure to pay dues or assessments within specified times brings the delinquent into suspension or his name may be dropped from the rolls if the case is greatly aggravated.

A member guilty of divulging the proceedings of the association or of disloyalty to the association may be tried at a meeting specially called for the purpose or at a regular annual meeting. If a majority of the members present find him guilty, he is expelled. Expulsion in such a case is permanent.

No resignations are accepted until all dues or assessments have been paid.

Meetings.—The annual meeting is held on the third Tuesday in April, at 10 a. m., at Miles City, Mont.

Special meetings may be called by the president, by either vice-president, or whenever requested by seven members. No other business may be transacted at a special meeting except that for which it is called.

A quorum of the association is twenty-five members; of the executive committee, seven members.

Proxies, made within sixty days of the date of meetings and approved by the executive committee, may be voted at all meetings.

Revenue.—Annual dues, \$5, and an annual assessment at the discretion of the executive committee not to exceed 1 cent per head on 70 per cent of all stock owned by members at the time of assessment.

Miscellaneous.—The by-laws may be amended by a two-thirds vote of the members present at an annual meeting.

NEBRASKA STOCK GROWERS' ASSOCIATION.

Same as the Montana association, with the following exceptions:

The association is governed by its articles of incorporation rather than by a constitution and by-laws.

Officers and management.—One vice-president. The executive committee is composed of fifteen members from the State at large.

The secretary-treasurer is not authorized to employ assistance.

The president and secretary-treasurer appoint a membership committee of three to pass upon applications for membership for recommendation to the executive committee.

There is no committee on resolutions.

The executive committee acts as a board of arbitration in disputes between members referred to it for settlement.

Membership.—Applicants must be proposed by a member and receive the favorable votes of the membership committee and the executive committee.

Membership is forfeited if assessments are not paid before July 15 following the date of levy.

Members accused of misconduct are tried by the executive committee, and expelled if found guilty by a majority vote.

Meetings.—The annual meeting is held on the second Tuesday in May at a place designated by the association at the previous annual meeting. The president, vice-president, or president pro tempore may call a special meeting, or this may be done at the request of five members of the executive committee. The executive committee meets immediately after election and on the call of the president, vice-president, president pro tempore, or three of its members. The executive committee meets immediately after election.

Eleven members of the association constitute a quorum at all meetings.

Revenue.—Admission fee, \$2.50, with exemption from annual dues for the first year; annual dues, \$2.50. Maximum limit of assessments 2½ cents per head on all stock owned by members at time of assessment.

Miscellaneous.—Amendments to the articles must be made in writing and filed with the secretary at least thirty days in advance of the meeting at which they are to be presented and a copy mailed to each member of the association.

NORTHWESTERN STOCK GROWERS' ASSOCIATION.

This organization is young, an offshoot of the Western South Dakota Stock Growers' Association, and is composed of men representing the smaller stockmen as opposed to the large ranchmen; accordingly, its membership includes owners of sheep. Its constitution is modeled on that of the Montana Stock Growers' Association. Exceptions may be noted as follows:

Object.—In enumerating the classes of stock protected, asses are omitted and sheep added. The energies of the association are directed toward enforcing the stock laws "of adjoining States" as well as those of South Dakota.

Officers and management.—One vice-president, and an executive committee of eleven members selected from the State at large. No outside representation. No provision for representation of new counties. There is no committee on resolutions.

At each annual meeting the president appoints a committee of three members on arbitration, "whose duty it shall be to examine into and render a decision on all questions of dispute arising between members of this association and referred to them for settlement."

Membership.—A "stockman" may own sheep as well as other classes of stock. The applicant must be proposed by a member of the association and his application must receive the favorable vote of a membership committee of three members and the secretary-treasurer. This committee reports its action, if favorable, to the executive committee, which body takes final action on the application.

Meetings.—Annual meeting at Bellefourche, S. Dak., on the second Tuesday in April, beginning at 2 o'clock p. m. Other places may be designated by the executive committee.

Special meetings may be called by the president, or, in his absence, by the vice-president, or at the request of five members of the association.

Eleven members of the association constitute a quorum.

Proxies, made within thirty days of the meetings and approved by the executive committee, may be voted at elections.

Revenue.—Admission fee, \$2; annual dues, \$2; an assessment not oftener than once a year, not to exceed 2 cents per head on all cattle, horses, and mules, and 2 mills per head on all sheep owned by members at time of assessment.

"Applicants for membership who are members of other associations or sheepmen and do not desire stock-yard inspection" by the Northwestern, are not assessed for that purpose.

Miscellaneous.—The by-laws may be amended only at an annual meeting by a majority vote of the members present.

WESTERN SOUTH DAKOTA STOCK GROWERS' ASSOCIATION.

The by-laws of this organization follow very closely those of the Montana Stock Growers' Association, to which the reader is referred. Among the exceptions may be noted the following:

Officers and management.—The executive committee consists of twelve members, elected from the State at large. No provision is made for representation from new counties.

Proxies are voted at elections only.

There is no committee on resolutions. An arbitration committee of three members of the association is appointed by the president at each annual meeting.

Membership.—Applicants must be proposed by a member of the association, and the applications are referred to a membership committee of three members and the secretary-treasurer. If their action is favorable, the application goes to the executive committee, whose action is final.

Meetings.—Annual meeting on the second Tuesday in April, at 1 o'clock p. m., at Rapid City, S. Dak.

Special meetings may be called in the usual manner or at the request of five members of the association.

Eleven members constitute a quorum for meetings of the association and three for meetings of the executive committee, of whom one must always be the secretary.

Revenue.—Admission fee, \$5, payment of which exempts from the annual dues for the first year; the maximum assessment is 3 cents per head for cattle and 2 cents per head for horses, mules, and asses owned by members at the time of assessment.

"Applicants for membership who are members of other associations and do not desire stock-yard inspection by our association shall not be assessed for that purpose."

ARIZONA CATTLE GROWERS' ASSOCIATION.

Object.—"To secure a better acquaintance, and to promote a more cordial friendship among the cattle growers of Arizona; to inculcate sound and correct principles of breeding and the growing of cattle; to prevent the stealing and driving away of cattle and horses from the rightful owners thereof; to assist and encourage the Ari-

zona Live Stock and Sanitary Board in their efforts to promote and build up the cattle business and the enforcement and execution of the stock laws of Arizona; to aid, encourage, and promote the enactment and passage of such stock laws as the present and future interest of the stock growers of Arizona demand and require."

Officers and management.—President, first and second vice-presidents, secretary, treasurer, an executive committee, and a board of control. The officers mentioned constitute the board of control and the executive committee is composed of the officers and three members of the association from each county in the Territory, making a total membership of forty-four.

In addition to the usual duties pertaining to his office, the secretary gives notice of all meetings, keeps a list of the names and addresses of the members, and collects the annual dues, paying them over to the treasurer.

The treasurer is required to give such bond as may be required by the executive committee.

No officer may hold his office longer than two successive years.

The books of the secretary and treasurer are audited at each annual meeting of the association.

Officers are allowed expenses incurred in performing their duties, but are allowed no other compensation.

At each annual meeting an auditing committee and a committee on resolutions of three members each are appointed by the president.

Except when the association is in session the executive committee has entire control over its affairs "not otherwise provided for." The members from each county have charge of the affairs of the association in that county, and are consulted by the board of control on all matters "relating to or originating within" that county.

The board of control has power to act for the executive committee "in ordinary matters," and has all the management and control of the association "not specifically designated to other officers, members, or committees." It may fix the date and place of the annual meeting of the association, and may call a meeting of the entire executive committee when necessary, and fills vacancies occurring from death or otherwise among the officers or members of the executive committee, such appointments being effective only until the next succeeding annual meeting. The board is responsible to the executive committee.

Membership.—Associations of cattle growers, firms, corporations, or individuals interested in any way in the cattle industry in Arizona are eligible to membership. The applicant must be recommended by one or more members, must state in his application the names of the individuals composing his firm, or the names and addresses of the officers of the association which he represents, must accompany his application with the initiation fee of \$5, and must receive the favorable vote of the board of control.

Persons becoming members bind themselves and employees to the observance of the by-laws and regulations of the association under penalty of forfeiture of membership.

Failure to pay dues on or before the annual meeting at which they become payable suspends the rights of membership until payment is made.

Meetings.—The association holds one meeting annually, the time and place being decided by it, or, in case of failure to do so, by the board of control. Special meetings may be called by the president at the written request of three members of the executive committee.

The secretary gives due notice of all meetings either through the public press or by letter to each member.

Five members of the association constitute a quorum, provided five counties are represented.

Revenue.—Initiation fee, \$5; annual dues, \$1.

OKLAHOMA LIVE STOCK ASSOCIATION.

The constitution is a modification of that of the Cattle Raisers' Association of Texas, to which attention is called. The following are among the exceptions noted:

Object.—To protect cattle raisers of Oklahoma, southern Kansas, and northern Texas.

Officers and management.—The offices of secretary and treasurer may be consolidated at any time. The president, secretary, and treasurer are members of the executive committee ex officio, which committee numbers seven. No provision is made for an assistant secretary, and there is no provision regarding limited tenure of office.

The secretary notifies members of their indebtedness semiannually, and failure to pay subjects members to the penalty of having their brands removed from the inspectors' books, but not to dismissal from the association. The secretary is empowered to draw a sight draft on members neglecting to pay such indebtedness within thirty days of notification.

The executive committee is not empowered to fix salaries and wages of employees. It elects its own chairman and secretary.

Membership.—Applicants must render for assessment not less than 25 head.

The provisions against encouragement of and sympathy for cattle thieves found in Articles XXV and XXVI of the Texas by-laws are omitted from the Oklahoma constitution, but the same provisions of punishment for stealing, etc., are provided.

Meetings.—On the second Tuesday of February of each year. It is not stated specifically how the date and place are fixed.

Four members of the executive committee constitute a quorum.

Revenue.—Membership fee, \$3; annual dues, \$2. Assessment not to exceed 2 cents per head on all cattle owned or controlled by members. If members do not render their cattle for assessment, the number shown by assessors' roll is taken as a basis.

Assessment dues are payable, on notice from the secretary, 1 cent per head on or before June 15 and 1 cent per head on or before December 1 of each year. On notice from the secretary these assessments may be collected quarterly at the rate of one-half cent per quarter.

Pasturage charges and disposition of cattle caught by inspectors are not mentioned in the Oklahoma constitution.

Miscellaneous.—The provisions of Articles XIII, XVI, XXI, XXV, XXVI, XXXVII, and XXXVIII of the Texas by-laws are entirely omitted from the Oklahoma constitution. The reader is referred to the Texas by-laws, appended to this article, for a closer comparison.

CATTLE RAISERS' ASSOCIATION OF TEXAS.

Object.—Mutual protection and benefit and the cultivation of a fraternal feeling generally among cattlemen.

Officers and management.—President, two vice-presidents, secretary, treasurer, and an executive committee of fifteen, of which the president and vice-president are members ex officio. The president is ex officio chairman of the executive committee. In addition to the usual duties of that officer, the president appoints the members of the executive committee, which appointments must be confirmed by the association.

The secretary gives bond, which must be approved by the executive committee. He keeps a record of the brands and marks used by members of the association, the list of cattle rendered for assessment, sends quarterly statements of their indebtedness to all members, and collects all funds due the association, including dues, assessments, pasturage on animals caught by inspectors of the association, etc., paying them over to the treasurer and taking a receipt.

The treasurer also gives a bond, approved by the executive committee, when the body requires it.

The executive committee has entire control over the association during adjournment. "It shall have the power to appoint inspectors, agents, and representatives, and an assistant secretary, if in their discretion such an officer shall be required, and shall fix salaries and compensations of all officers and employees of the association; shall offer rewards, and do any and all things which the association could do if in session, and its action shall be binding on the association. It shall audit all accounts of the association, and at each annual meeting make a report covering all matters requiring the attention of the association, and recommend such measures as it shall deem of importance for the action of the association." This body approves the bonds of the secretary and treasurer, passes upon applications for membership, passes upon bills and claims against the association not included under the head of printing and advertising and stationery needed by the secretary's office, levies assessments, acts as a board of investigation of charges against members, has power to suspend or expel, and is a board of arbitration in disputes between members regarding the ownership of animals held by inspectors of the association.

The executive committee elects its own secretary.

Elected officers hold office for one year, or until their successors are elected and installed, but no person may hold the office of president or vice-president longer than two terms in succession.

At least four members of the executive committee must be retired each year.

Membership.—Persons owning or controlling cattle, and 18 years of age or over, are eligible to membership.

Persons desiring membership make application to the secretary on blanks supplied by him. The applicant must be indorsed by two members in good standing, and must accompany his application with the initiation fee. He must receive the favorable vote of the executive committee and the favorable vote of a majority of the members of the association and must "render for assessment all cattle owned or controlled by him" before he is accepted as a member.

Each member is required to file with the secretary "a list of his brands and marks accompanying such brands, as nearly as possible, for all cattle for which he asks protection, the number of said cattle to be not less than the number rendered by him for taxation, and to include all other cattle owned or controlled by him, with the number of his cattle, his post-office address, location of ranch," etc. These records are always open to members of the association.

Members are required to report to the association all cases of "marking, branding, killing, driving, milking, or in any way using or appropriating any cattle" not the property of the person committing these acts, unless he has the authority of the owner.

A member may withdraw from the association by making formal application to the secretary and discharging all indebtedness, provided that there are no charges against him "for violations of the by-laws, rules, and regulations of the association."

Failure to pay annual dues and assessments subjects a member to having his brand removed from association records, the loss of protection, and forfeiture of membership.

Members going on the bond of persons charged with cattle stealing who are not members or their employees forfeit membership.

Offenses for which a member may be expelled are to "mark, brand, kill, or sell, or in any way appropriate for his own use or benefit any stock not his own and without proper authority from the owner." To "drive other cattle than his own from their accustomed range" is regarded as "violating the good intentions of the association," and subjects the member to "expulsion, suspension, or reprehension," as the gravity of the case demands.

Members charged with the theft of cattle may be suspended by the executive committee in its discretion, and, if convicted, expelled from the association by that

body, the right of appeal to the association being allowed at the succeeding annual meeting.

Charges against members of acts punishable by expulsion, suspension, or reprehension are presented to the executive committee verbally or in writing, with the evidence at hand. The committee investigates them, and, if it deems them sufficient, instructs the secretary to summon the member accused to appear before the association to stand trial. If the executive committee does not deem the charges sufficient, the accuser may present them to the association at its next annual meeting for its consideration.

The executive committee may investigate charges on its own initiative, with the usual course.

When charges are preferred and brought before the association, a fair trial is allowed at an annual meeting, and a majority vote of the members present may convict. After conviction, the association votes for the kind of punishment, which may be expulsion, suspension, or reprehension, a majority vote deciding.

Suspended members are not entitled to any of the privileges of the association, but are accountable to it for their conduct. At any stated meeting they may be reinstated by a favorable majority vote.

Expelled members may apply for new membership after twelve months from date of expulsion.

Meetings.—Annual, on second Tuesday in March. The place where this meeting is held is decided by the association in annual meeting.

The executive committee meets immediately after their appointments are confirmed by the association and selects a secretary. Their regular meetings are held on the last Mondays of May, August, and November. Special meetings may be called by the secretary. Five members constitute a quorum, and their action is final "unless rescinded by the entire executive committee."

Revenue.—Initiation fee, \$5; annual dues, \$5; 10 per cent of the sales of all cattle caught by inspectors of the association and sold belonging to the association; an assessment, if needed, not to exceed 2½ cents per head on all cattle owned or controlled by members.

NORTH MONTANA WOOL GROWERS' ASSOCIATION.

Object.—Protection and promotion of the wool and mutton interests of Montana.

Officers and management.—President, three vice-presidents, secretary, and treasurer. All but the treasurer constitute the executive committee.

In addition to the usual duties of the office, the president is specifically charged with the general supervision of the association, is chairman of the executive committee, and delivers an address on sheep husbandry at the annual meeting.

The secretary receives money due the association, pays it to the treasurer, taking a receipt, and publishes, "as far as practicable," an annual report containing the transactions of the association and the papers and addresses presented at the annual meeting.

The executive committee has power to levy assessments for the support of the association.

At each annual meeting the president appoints a ways and means committee of two members from each county in the State; among other duties the members of this committee may grant applications for membership and receive membership fees, giving receipts for them. No officers are paid salaries except the secretary, who receives \$100 per annum, payable at the close of the year.

Officers are elected annually.

Membership.—Wool growers residing in Montana.

Meetings.—The association meets in July of each year at Great Falls, Mont. Special meetings may be held at any time on call of the president.

The executive committee meets on call of the president or three of its members. Three members constitute a quorum.

Revenue.—Membership fee, \$5; assessments at a rate per 1,000 sheep owned by members as shown by the assessment rolls in the different counties. The executive committee fixes the rate of assessment.

UTAH WOOL GROWERS' ASSOCIATION.

Object.—"To defend the individual members from oppression of any kind and to make a common cause of any injury or injustice inflicted upon a member; to protect the rights of the wool grower in the use of the range, the water courses and springs, and his right to the use of the public highways; to provide a fund that can be used at any time in defense of our rights, or to prosecute to a final determination suits in the courts of law, for any injustice which may be committed on members of this association."

Officers and management.—President, vice-president, secretary, treasurer, and an executive committee of seven, of which the officers named are members ex officio. There is also a vice-president for each county in the State.

In addition to his regular duties, the president receives applications for membership and approves the bonds and sureties of the secretary and treasurer.

The county vice-presidents represent the interests of the association in their respective counties and receive applications for membership.

The executive committee receives complaints of "damages of whatever kind or nature, wrongs, indignities, extortion, or oppression done to or suffered by any member," and carries these cases into the courts if the facts warrant such action. The committee may fill vacancies in any office and "has general direction and supervision of all the work of the association."

The officers serve one year, or until their successors are elected and qualified. The secretary receives such compensation as the association may determine. The secretary and treasurer are required to give bonds of \$1,000 each, "with two good and sufficient sureties."

Only wool growers are eligible to office.

Membership.—Sheep raisers, wool growers, and wool dealers in Utah are eligible to membership. Applications are made to the president or county vice-president. Failure to pay the yearly dues to the association forfeits the right to protection.

Meetings.—Annual meeting on April 6 at Salt Lake City. Special meetings may be called by the president at his discretion or at the request of five or more members. Twenty-five members constitute a quorum.

Revenue.—Initiation fee, \$1; annual dues from persons who are not sheep owners, \$1; wool growers are assessed \$1 per thousand sheep owned by them.

SPECIMEN CONSTITUTIONS OF LIVE STOCK ASSOCIATIONS.

In the following pages the constitutions of a number of these associations are appended for the information of those who may desire more complete details regarding their methods of organization and government.

The constitution of the California Live Stock Breeders' Association may serve as a model for Pacific coast breeders or those similarly situated; the Missouri and Kansas constitutions are typical of the corn-belt associations; the constitution of the Montana Registered Cattle Breeders' Association contains many excellent suggestions for breeders who are pioneers in live-stock improvement; and with the Ohio Horse

Breeders' Association serves as an illustration of an organization to promote a special class of stock. All of these illustrate the educational associations. Those which are mainly protective are represented by the Montana Stock Growers' Association, the Cattle Raisers' Association of Texas, and the Utah Wool Growers' Association. These latter ones also illustrate associations organized for the promotion and protection of live stock interests in general and of those of special classes.

These constitutions, by-laws, rules, and regulations are inserted solely for purposes of information and the Bureau of Animal Industry does not assume responsibility for any sentiments expressed therein.

California Live-Stock Breeders' Association.

CONSTITUTION AND BY-LAWS.

NAME.

This organization shall be known as the California Live Stock Breeders' Association.

OBJECT.

The object of the California Live Stock Breeders' Association is to encourage the breeding of purebred live stock, to improve the breeds of domestic animals in California, to secure adequate recognition of our animal industry from the State legislature and public officers, to provide for a comprehensive plan of agricultural education, to collect live-stock statistics and disseminate information respecting the superiority of pure-bred animals, to hold live-stock conventions, to promote live-stock exhibitions, to enlarge the usefulness of the State fair, and in general to contribute to the prominence of California as a live-stock breeding center.

OFFICERS.

The officers of this association shall consist of a president, vice-president, secretary, treasurer, and a board of seven directors. The president, secretary, vice-president, and treasurer shall be ex officio members of the board of directors, and a majority of the board shall constitute a quorum for the transaction of business.

DUTIES OF PRESIDENT.

It shall be the duty of the president to preside at the meetings of the association, and in his absence the vice-president shall be the presiding officer.

DUTIES OF THE SECRETARY.

It shall be the duty of the secretary to keep a record of all the meetings of the association, to receive all moneys and dues due the association, to pay the same over to the treasurer, taking his receipt therefor, to receive all applications for membership and refer same to the board of directors, to keep a list of members, with their residences, dates of joining, class of stock, and families of same, to collect live-stock statistics, and he shall receive for his services such compensation as the board of directors may order.

DUTIES OF DIRECTORS.

It shall be the duty of the board of directors to pass upon all applications for membership, to have general supervision of the association under such rules and regulations as may from time to time be subscribed, and in general to promote the objects for which this association was formed.

MEMBERSHIP.

All residents of the State of California who are engaged in improving the standard of the live stock of the State, editors of live-stock and agricultural papers, and experiment-station officials from any experiment station in the United States who have been approved by the board of directors are eligible to membership.

EXPULSION.

If any member shall willfully misrepresent any stock or do any act derogatory to this association, he shall be expelled, providing that two-thirds of the members present at an annual meeting shall vote for such expulsion. It shall be the duty of the secretary to notify the offending member of the charges against him thirty days before such meeting, when he will be permitted to appear and be given a hearing.

MEETINGS.

The annual meeting of this association shall be held at Sacramento on the second Tuesday of the State fair. Twenty-five members of the association shall constitute a quorum at the annual meeting. The board of directors shall hold meetings at such times and places as may be necessary to transact the business of the association, and upon the written request of ten members the president shall call a special meeting. It will be the duty of the secretary to notify each member of the association of the annual meeting ten days previous thereto.

AMENDMENTS.

This constitution may be amended at any annual meeting by a two-thirds vote of the members present, provided notice of such amendment is given sixty days previous to the annual meeting.

DUES.

The annual dues of this association shall be three dollars (\$3), and if any member shall neglect to pay his dues for one year his name shall be dropped from the membership roll.

ELECTIONS.

All officers of this association shall be elected by ballot at the annual meeting, and shall hold office for one year or until their successors have been elected and qualified.

Kansas Improved Stock Breeders' Association.

CONSTITUTION.

ARTICLE 1. This association shall be known as the Kansas Improved Stock Breeders' Association.

ART. 2. The objects of this association shall be to promote the interests of breeders of the various breeds of improved live stock in Kansas.

ART. 3. The officers of this association shall consist of a president, vice-president, secretary, treasurer, and a board of five directors, which, together with the president, secretary, and treasurer, shall constitute an executive committee.

ART. 4. The officers of this association shall be elected at each annual meeting.

ART. 5. Any person interested in the improved breeds of live stock may become a member of this association by the payment of a membership fee of \$1, and thereafter an annual due of \$1 shall be collected from each member of this association.

ART. 6. The regular annual meeting of this association shall be held at Topeka on the second Tuesday of January each year at 10 a. m.

ART. 7. This constitution may be altered or amended at any annual meeting of this association by a two-thirds vote of all the members present.

BY-LAWS.

1. The president shall preside at all meetings; he shall fill by appointment all temporary vacancies in offices, appoint all committees not otherwise provided for, and perform all other duties pertaining to the office of president.

2. The vice-president shall preside in the absence of the president and perform all the duties pertaining to the office.

3. The secretary shall keep a roll of all the members, with their post-office addresses (and class of stock bred). He shall record in a book kept for that purpose all the proceedings of the association, and receive and pay over to the treasurer all fees, dues, and other money paid to the association, conduct the correspondence of the association, and perform such other duties as pertain to his office.

4. The treasurer shall receive from the secretary all money coming into the hands of the association and disburse the same on order of the executive committee, and make a detailed report of said receipts and disbursements at each annual meeting.

5. It shall be the duty of the executive committee to prepare a programme for each annual meeting and furnish copy of the programme to each member of the association at least thirty days previous to the annual meeting. They shall also provide for the publication of annual reports and have general supervision of the business affairs of the association.

6. Order of business:

Calling roll.
Reading minutes of last meeting.
President's annual address.
Reports of officers.
Reports of committees.
Communications.
Unfinished business.
New business.
Election of officers.
General programme.
Adjournment.

7. These by-laws may be amended by a two-thirds vote of all the members present at any annual meeting of this association.

Missouri Improved Live Stock Breeders' Association.

CONSTITUTION.

SECTION 1. This organization shall be known as the Missouri Improved Live Stock Breeders' Association.

SEC. 2. The purposes of this organization are to include in its membership all who are interested in the encouragement and upbuilding of an increased interest among all the breeders of the various breeds of improved live stock; and for mutual benefit and the disseminating of information calculated to awaken a more general interest among breeders, farmers, and feeders, to the end that better methods may prevail.

SEC. 3. The officers of this organization shall consist of a president and one vice-president for each breed represented in its membership, a secretary who shall be ex officio treasurer, an executive committee consisting of the president and secretary and three members to be appointed by the president.

SEC. 4. Election of officers. The president, vice-president, and secretary and ex officio treasurer shall be elected at each annual meeting by ballot and serve until their successors are elected and qualified.

SEC. 5. Membership. Anyone may become a member of this organization by making application to the secretary to have his name enrolled.

SEC. 6. Membership fees and annual dues. There shall be no membership fees or annual dues charged unless otherwise ordered by a majority vote of the members present at an annual meeting.

SEC. 7. Meetings. The meetings of this association shall be held at such time and place as may be decided upon by the executive committee.

BY-LAWS.

SECTION 1. Duties of president and vice-presidents. It shall be the duty of the president to preside at all meetings and to call such meetings of the executive committee as may seem necessary. It shall be the duty of the several vice-presidents to cooperate with the executive committee and look after the membership and interests of the special breed which he represents.

SEC. 2. Duties of secretary and ex officio treasurer shall be to keep the minutes of all meetings and record them in a book kept for that purpose. To receive and pay out all moneys, keeping a correct account of the same. He also shall be required to each year make a report to the annual meeting. He shall turn over all records and accounts to his duly elected successor in office.

SEC. 3. Duties of executive committee. The executive committee shall have charge of all the business affairs of this association, also to select a time and place for holding each succeeding annual meeting; to examine the books and accounts of the secretary and treasurer; to arrange programme for each annual meeting and have same ready for publication at least four weeks in advance of date of meeting.

SEC. 4. Annual meeting. At each annual meeting the time and place for the next regular meeting shall be decided upon by the executive committee acting jointly with the executive committees from the several organizations composing the Industrial Association. The time and place for the annual meeting shall be given due announcement through the agricultural press.

Montana Registered Cattle Breeders' Association.**DECLARATION OF OBJECTS.****NAME.**

This association shall be known as the Montana Registered Cattle Breeders' Association.

OBJECTS.

The improvement of cattle in the herds of the Northwest, the encouragement of better breeding and introduction of pure blood into the herds of the State; to promote and aid county, district, and State exhibits by breeders where friendly competition will lead not only to improvement among breeders who exhibit, but create interest among cattle breeders generally; to produce a class of cattle that shall be equal to any in the Union; to afford mutual protection and aid to breeders, and to promote quarterly, semiannual, or annual public sales of pure-bred cattle owned in Montana.

BY-LAWS.**QUALIFICATIONS OF MEMBERS.**

SECTION 1. Any reputable owner or breeder of pure-bred cattle whose residence is in Montana may become a member of this association upon approval by the board of directors and payment of initiation fee of five dollars (\$5), which shall be the annual fee of membership. Applications for membership shall be made to the secretary, who shall bring the application before the board of directors for their approval. The secretary shall report the action of the board upon said application to the applicant. When an application is approved by the board the membership fee shall be paid by the applicant within twenty days after notification of such approval by the secretary, and thereupon the applicant shall be enrolled as member of the association.

MEMBERSHIP BY CORPORATIONS, FIRMS, AND COPARTNERSHIPS.

SEC. 2. An incorporated company may become a member of this association the same as an individual, and a firm composed of two or more partners may likewise become a member. Any individual partner in any firm may have membership separate and apart from his said firm on payment of his membership fee and assessments. Memberships in this association are nontransferable and terminate with the life of the member or the dissolution of the firm or corporation.

OFFICERS.

SEC. 3. The officers of this association shall consist of a president, vice-president, secretary, and treasurer, all of whom shall be members of the association, excepting the secretary, who may or may not be a member.

DUTIES OF OFFICERS.

SEC. 4. The president shall be elected by a majority vote of all the members present or represented by approved proxies at each annual meeting, and shall hold office for one year, or until his successor is elected and qualified. The president shall be the chief executive officer of the association, who shall see that the laws are enforced and who shall see that each and every officer of the association performs the duties required of him by the by-laws. He shall preside at all meetings of the association when present and of the board of directors, and perform such other duties as the by-laws and rules may impose upon him. He shall execute all contracts of the association which shall have been authorized by the board of directors.

SEC. 5. The vice-president shall be elected in the same way as the president at each annual meeting, and hold office for one year, or until his successor is elected and qualified. He shall perform all the duties of the president in case of the absence or inability of the president or upon the request of the president. In case of the death or removal of both president and vice-president, the board of directors shall choose a president to act until the next annual meeting.

SEC. 6. The secretary shall be the clerical officer of the association, and shall hold his office for one year, or until a successor is elected and qualified. It shall be the duty of the secretary to keep and preserve correct and accurate minutes of all meet-

ings of the association in a special record book for that purpose, and to be the custodian of such records. He shall keep the books and accounts of such association, attend to its correspondence, and perform such other duties as the board of directors may direct, and shall receive such compensation for his services as the board of directors may deem fit. The secretary shall give bond for the faithful performance of the duties imposed in such sum as the board of directors may direct, the premium on said bond to be paid by the association. The secretary shall not buy nor sell cattle on commission, nor shall he be interested in the sale of cattle belonging to others, except in such manner as the board of directors shall permit and authorize. He shall attest to all contracts made by the association, which shall have the approval of the board of directors and be executed by the president.

SEC. 7. The treasurer shall have charge and custody of the funds and securities of the association and shall deposit the same in a safe manner, paying the same as the board of directors may direct. He shall give bond in such a sum and in such manner as the board of directors shall designate, the association paying the premium on said bond.

SEC. 8. The management of the association shall be vested in a board of five directors, who shall be elected by a majority vote of all members present at the regular annual meeting of the association, which shall be at such date and at such place as the board may direct. The board of directors shall have the entire charge and management of the property of the association, and shall have power to employ help and assistants in any department of the work that they may deem for the best interests of the association. It is the duty of the board to encourage breeding and to maintain unimpaired the purity of all registered cattle and to protect and promote by all lawful means the interests of pure blood as their judgment may dictate; to offer premiums for the exhibition of superior animals and to receive contributions and to appropriate association moneys for such purposes. The board of directors shall cause to be kept an accurate record of their meetings and all transactions in the special record book.

SEC. 9. The board of directors shall hold an annual meeting for the transaction of business as soon as practicable after the annual meeting of the association and at such place as a majority of the board may elect. They shall hold special meetings at such time and place as they may deem necessary for the proper management and transaction of the business of the association. Special meetings shall be called either by a majority of the members, by a majority of the board of directors, or by the president.

All directors shall receive sufficient notice of a special meeting to enable them to reach the place designated and a majority of the board may transact business.

SEC. 10. The officers and directors of the association may receive their necessary expenses paid out by them in the transaction of the necessary business of the association, but shall receive no compensation for their services.

SEC. 11. There shall be an annual meeting of the association for the election of officers and directors and for the transaction of business at a place and date set by the directors. The secretary shall notify all members by written or printed notice within ten days after being notified of the date and place by the directors, and the said directors shall name the date and place to the secretary at least thirty days prior to said meeting. At any annual or special meeting a majority of members of the association present shall have power to transact business. No member shall be permitted to vote unless his membership fee has been paid.

ORDER OF BUSINESS AT SPECIAL OR ANNUAL MEETINGS.

SEC. 12. The regular order of business at the annual and special meetings shall be as follows;

1. Roll call of members and submission of proxies.
2. Reading of minutes of previous meetings and action thereon.
3. Address of the president.
4. Report of board of directors.
5. Report of the secretary.
6. Report of the treasurer.
7. Report of committees.
8. Election of officers.
9. Miscellaneous.

The regular order of business may be suspended at any time by a two-thirds vote. Election of officers shall be by ballot if there is more than one nomination for one office or more than five nominations for directors.

MISCELLANEOUS.

Sec. 13. It shall be the duty of every member to furnish to this association and to the national association to which he may belong all information regarding the violation of rules, or of any act by any member or any other person that would tend to bring censure on this or any other recognized association, and shall aid in every way the detection of frauds in pedigrees or attempts to deceive. The board of directors are hereby empowered to expel from this association, after due investigation and a hearing of the accused, any member whom they deem guilty of a violation of the rules of the association, or who may be deemed guilty of any act that will tend to injure the interests of purebred cattle or the breeders thereof.

Ohio Horse Breeders' Association.

CONSTITUTION.

ARTICLE I.

This association shall be known as the Ohio Horse Breeders' Association.

ARTICLE II.

The object of this association shall be to promote the various breeds of horses in the State of Ohio, and to protect importers, breeders, and purchasers of such horses against injury resulting from persons wrongfully claiming full-blooded and pedigreed animals and selling the same as such; to promote the general improvement of breeding and feeding and caring for horses; for the education of the individuals engaged therein, and for the mutual benefit of the members of this association.

ARTICLE III.

The officers of this association shall consist of a president, vice-president, secretary, treasurer, and executive committee of five, of which the president, and in his absence the vice-president, and the secretary shall be ex officio members.

ARTICLE IV.

SECTION 1. Any person of good character who is engaged in importing purebred horses or in the breeding of horses, whether purebred or not, in the State of Ohio, shall be eligible for membership in this association, and, upon the recommendation of some member of this association in good standing, may become an active member by the payment of \$1 annually to the secretary. Persons residing in Ohio who are not engaged in the business of importing purebred horses and are not engaged in breeding horses, but are engaged in the business of dealing in horses in this State, are eligible to membership in the association as subscribing members thereof, when recommended as aforesaid, and shall have all the rights and privileges of active members except the right to hold office, vote for officers, or to vote upon the adoption or amendment of the constitution and by-laws.

Sec. 2. All persons who may become members shall be subject to and be governed by the constitution and by-laws.

ARTICLE V.

SECTION 1. There shall be at least two stated meetings each year, one to be held in January and one during the Ohio State fair, at such times and places in the city of Columbus as the president and secretary may designate.

Sec. 2. All meetings of the association are subject to the call of the president, who shall notify the secretary and he notify the members of such meetings.

Sec. 3. The president and secretary shall select suitable persons at each annual meeting to prepare and read papers on the subjects of breeding, feeding, and caring for horses, and such other subjects within the scope of the association as they may select.

ARTICLE VI.

This constitution may be amended by adding to or taking therefrom at any annual meeting of the association by a two-thirds vote of the active members present.

BY-LAWS.

ARTICLE I.

SECTION 1. The annual meeting of the association in January shall be held in the city of Columbus, Ohio, on the day preceding the day of the annual convention of

the State board of agriculture of Ohio, and at such place as may be provided by the secretary of the association and secretary of the State board of agriculture.

SEC. 2. The officers shall be elected by ballot at each annual meeting in January.

SEC. 3. At the annual meeting in January the secretary and treasurer shall make their reports, and the president shall appoint an auditing committee to audit their reports.

SEC. 4. Special meetings of the association may be called by the president, or, in case of his absence or disability, by the vice-president, at a time and place designated in the notice.

ARTICLE II.

At each annual meeting of the association in January the following shall be the order of business:

1. Calling to order by president.
2. Reading minutes.
3. Secretary's report.
4. Treasurer's report.
5. Reports of committees.
6. Unfinished business.
7. New business.
8. Election of officers.
9. Reading of papers on topics named.

At the annual meeting during the State fair matters of general interest, except as hereinafter provided, may come up for discussion and action.

ARTICLE III.

SECTION 1. The president shall preside at all meetings of the association. He shall call such meetings as are provided for in the by-laws. He shall countersign all warrants drawn upon the treasurer by the secretary, and shall perform such other duties as usually devolve upon such officer.

SEC. 2. The vice-president shall perform the duties of the president in case of his absence.

SEC. 3. The secretary shall have charge of all the books and records of the association. He shall attend and accurately record the proceedings of all meetings of the association. He shall draw all warrants on the treasurer. He shall receive all moneys due the association and pay the same to the treasurer, and charge the same in account to the treasurer in a book kept for that purpose. He shall prepare and issue all proper notices of all meetings of the association, and to all officers, notifying them of their election, and submit to the annual meeting of the association in January a true and correct report of his transactions with the association and the treasurer, and perform such other duties as may be required of him by the president.

In addition to other records kept by him, the secretary shall either in person or by an assistant secretary appointed by him and approved by the president, keep two records in book form, one of which shall be called the "Breeders' Record" and the other the "Sale Record." Any horse, mare, colt, or filly owned by any member shall be eligible to entry in the Breeders' Record, and at the owner's request shall be entered therein by the secretary or his assistant, who shall state the name and address of the owner, and the name, age, sex, and breed of the animal, with a pertinent description of the latter, and if any animal so entered be registered in any recognized studbook, the registry number shall be stated and the studbook in which such registration is made; and if any animal so entered be eligible to such registration, but not registered, he shall state to what studbook it is eligible and under what rule or on what ground the owner claims the right of registration; and if the owner so directs a record shall be made of the terms of service of any stallion so entered.

In the Sale Record any horse, mare, colt, filly, or gelding of any member shall be eligible for entry if such animal be for sale. Such entry shall include the name and address of the owner, and a statement of the name, age, sex, and breed of the animal, and, if the owner so directs, the price and terms of sale. No animal shall be entered in either of said records unless the owner thereof be an active or subscribing member of this association, and for each animal registered the charge shall be 25 cents, payable when the entry is made.

Said records shall be open at all times to the inspection of officers and other members of the association, but not to any other person except as hereinafter stated. With the consent of any owner of an animal so entered his name and address may be furnished to any prospective breeder or purchaser, whether a member of the

association or not. On the payment of 50 cents the secretary or his assistant shall permit any prospective breeder or purchaser, who is not a member of the association, to inspect, or shall furnish him by letter information concerning any entries in said records concerning any animals whose owner shall have authorized such information to be given.

The secretary or his assistant shall furnish to the members of the association without charge printed blanks on which to request entries to be made in said records. When any animal entered in either of said records is sold, the date of sale, and the name and address of both seller and purchaser shall be recorded in the Sale Record, at the request of either seller or purchaser on the payment of the sum of 25 cents. The secretary or the assistant secretary, if the services be performed by the latter, shall receive as his compensation the fees received as aforesaid.

SEC. 4. The treasurer shall receive and shall keep and disburse all moneys belonging to the association, and shall pay them out on warrants drawn by the secretary and countersigned by the president. He shall keep a regular account of the money received and paid out by him, and shall make an annual report thereof at the stated meeting in January. He shall hand over to his successor in office any balance of money remaining in his hands as such treasurer at the end of his term of office.

Montana Stock Growers' Association.

BY-LAWS.

SECTION 1. This association shall be known as the Montana Stock Growers' Association.

SEC. 2. The object of this association is to advance the interests of the stock growers in Montana and adjoining States and Territories, and for the protection of the same against frauds and swindlers, and to prevent the stealing, taking, and driving away of cattle, horses, mules, and asses from the rightful owners thereof, and to enforce the stock laws of the State of Montana.

ELECTION OF OFFICERS.

SEC. 3. The affairs of this association shall be conducted and managed by a president, first vice-president, a second vice-president, a secretary and treasurer combined, and an executive committee. The executive committee shall consist of one member each for Flathead, Granite, Missoula, Ravalli, Broadwater, Deerlodge, and Silverbow counties, and for Wyoming, North and South Dakota, and Northwest Territory; two members each for Beaverhead, Sweet Grass, Powell, Meagher, Carbon, Gallatin, Jefferson, Madison, and Park counties; three members each for Cascade, Yellowstone, Teton, and Valley counties; five members each for Custer, Dawson, Choteau, Rosebud, Fergus, and Lewis and Clarke counties. Seven members shall constitute a quorum. All regular officers of the association shall be ex officio members of this committee. These officers and above-named committee shall be elected at the annual meeting in April of each year, and shall serve until the spring meeting following their election or until their successors have been elected. Written proxies, approved as genuine by the executive committee and made within sixty days, may be voted at all meetings. The executive committee is empowered to fill any vacancies that may occur, by death or otherwise, in their own body or among the officers of this association, and the person so appointed shall hold office until the next regular election. The executive committee are empowered to provide representation on their committee for any new counties which may hereafter be created.

DUTY OF OFFICERS.

SEC. 4. The president shall preside at all meetings of the association. He shall see that all the by-laws, resolutions, and regulations thereof are faithfully executed, and perform such other duties as may be required of him in these by-laws, as well as such as may be necessary to secure the objects and best interests of this association not herein otherwise provided for.

SEC. 5. The first vice-president, in the absence of the president, shall perform the duties of the latter, and if he shall be absent the second vice-president shall act, and if both be absent at any meeting a president pro tempore may be elected.

SEC. 6. The secretary-treasurer shall keep accurate minutes of the transactions of this association. He shall keep a roll of members and a correct account of all moneys

received. He shall write and send all communications for the association and such as he may be directed to write and send by the association or executive committee. He shall pay all bills when directed by the executive committee, and he shall make a full report of all the transactions of his office at each annual session and at such other times as the association may direct, producing therewith vouchers for all moneys paid out. He shall deliver to his successor all books, papers, moneys, and other property in his possession belonging to the association, and perform such other duties as may be required by these by-laws, resolutions, and regulations, or by the association. He is authorized to employ such assistance as he may deem necessary, at a reasonable rate of compensation. He shall keep a record of the brands and such other information concerning the members, stock, range, etc., as may be furnished him by the members. He shall give bond to the association in such sum and with such sureties as may be required by the executive committee, conditioned that he will faithfully perform all acts and things required of him in this section, and he shall receive such compensation as the executive committee may determine.

SEC. 7. The executive committee may meet immediately after their election and at such other times as they may be called together by the president. The president or vice-president shall preside at all meetings. The secretary-treasurer shall act as the secretary of the committee. The committee shall have entire control of the employees and all the business of the association during its adjournment. It shall audit all accounts and order the secretary-treasurer to pay all bills. They shall represent the association before the State board of stock commissioners, boards of county commissioners, and the legislature, and in other similar positions, during adjournments of the association. At each annual meeting this committee shall make a report to the association in regard to matters requiring their attention, and shall recommend such measures as they deem necessary. Each member shall report at the meeting of the committee such matters as require attention in his locality, and shall look after and give attention to the interests of the association for the county he represents.

SEC. 8. The annual meeting of this association shall be held on the third Tuesday in April, at 10 o'clock a. m., in Miles City, Mont., at such place as the executive committee shall determine, due notice thereof being given. Special meetings may be called at any time by the president, or in his absence by either of the vice-presidents, and shall be called whenever requested by seven members. Twenty-five members shall constitute a quorum for business at all meetings. The call for a special meeting shall state the object and place of such meeting, and no other business shall be transacted at such meeting. At each meeting of the association it shall be the duty of the chair to appoint a committee of five members, to whom all resolutions offered shall be referred without debate, except such as come from the executive committee or board of stock commissioners with their recommendations for adoption, which shall be put to vote without reference to the committee on resolutions.

ORDER OF BUSINESS AT MEETINGS.

1. Call to order.
2. Calling the roll.
3. Reading minutes of last meeting.
4. Report of secretary-treasurer.
5. Appointment of committees—resolutions, nominations, membership.
6. General business.
7. Report of membership committee and election of new members.
8. Report of resolutions and nominations committees.
9. Election of officers, including executive committee.
10. Unfinished business.
11. Adjournment.

MEMBERSHIP.

SEC. 9. No person shall be a member of this association except a stock grower as defined by the following, viz: A person owning or controlling cattle, horses, mules, or asses, and engaged in the business of breeding, growing, or raising the same for profit. To become a member of this association, all persons must be proposed by a member. Each proposition shall be accompanied by a fee hereinafter specified, together with a statement of the number of cattle, horses, mules, and asses owned or controlled by such person or his firm or company, with all the brands and marks of such stock; also the names of the individuals comprising his firm or names of all the officers, if a company, and the post-office address of each, and his application shall be referred to the standing committee on membership, consisting of three members of the executive committee and the secretary and treasurer of the associa-

tion, who shall examine said application, and if they deem the applicant a proper person the secretary shall so notify him and place his name upon the list of members. All persons admitted as members bind themselves and their employees to the observance of all by-laws, resolutions, and regulations of the association that are now in force, or that may hereafter be adopted, on a penalty of forfeiture of membership. Memberships must be personal.

SEC. 10. The annual dues shall be \$5, payable at the April meeting of each year, and no one shall become a member without such payment. Any member failing to pay his dues on or before the next spring meeting when the same shall become due shall cease to be a member until such payment has been made. Any member who shall be in arrears for more than one year for dues or assessments shall be dropped from the roll of members. All members shall be subject, not oftener than once per annum, to an assessment not exceeding 1 cent a head on 70 per cent of all cattle, horses, mules, and asses of which each person may at that time be the owner, and no resignation shall be accepted until all dues and assessments are paid. This assessment shall be levied in the discretion of the executive committee, and shall be payable when called for. Failure to pay on or before the next annual meeting following date of such assessment shall work a forfeiture of membership. The fund so assessed shall be collected by the secretary and treasurer, and shall become a part of the common fund of the association, subject to the same regulations as before provided.

SEC. 11. Any member who shall divulge the proceedings of or action taken in any meeting of the association to any person or persons, or do any act calculated to or that may injure or defeat any proceedings or action of this association or officers thereof that may be instituted for the purpose of its protection or that of any of its members under the laws of this State or of these by-laws, resolutions, and regulations, or that may be subversive of the interests generally of the association, shall have a fair and impartial hearing at a special meeting called for that purpose, or at the annual meeting, and if found guilty by a majority of the members present shall be expelled.

SEC. 12. Any member of this association who shall be expelled therefrom as aforesaid shall not again be received as a member thereof, and stock growers generally shall be notified of such expulsion.

SEC. 13. Whenever it shall come to the knowledge of any member of this association that any person or persons are engaged in stealing or killing stock of any kind, he shall immediately notify the executive committee of the association, who are hereby empowered to act in such manner as will, if possible, bring such person or persons to justice and recover said property.

SEC. 14. These by-laws, regulations, and resolutions shall not be annulled or amended except at the annual meeting, and then only by a vote of two-thirds of the members present.

Cattle Raisers' Association of Texas.

BY-LAWS, RULES, AND REGULATIONS.

PREAMBLE.

Believing that the cattle interests of Texas can be better guarded and promoted by a more perfect understanding and thorough organization among the parties interested, therefore we whose names are hereto attached do hereby organize ourselves into an association for mutual protection and benefit, and to cultivate a more fraternal feeling among cattlemen generally; and do hereby adopt the following by-laws, rules, and regulations, and further pledge ourselves to do all in our power to maintain the same:

ARTICLE I.

This organization shall be known as the Cattle Raisers' Association of Texas, and shall be composed of such cattlemen as are now members and such as may be elected as hereinafter provided.

ARTICLE II.

The officers of this association shall be one president, two vice-presidents, one secretary, one treasurer, and an executive committee of fifteen members, of which the president and vice-presidents shall be ex officio members. All officers shall be elected by the association, the majority of the votes cast being necessary to an election, and

shall hold office for one year or until their successors shall be elected and installed: *Provided*, That the members of the executive committee shall be nominated by the president and confirmed by a vote of the association, and that no one shall be elected president or vice-president for more than two successive terms, and that not less than four of the executive committee shall be retired each year. The president shall be ex officio chairman of said executive committee.

ARTICLE III.

It shall be the duty of the president to preside over all meetings of the association, to preserve order and decorum, to announce the result of the balloting, to decide all points of order in controversy, subject to an appeal to the house, to see that all rules and regulations are enforced, and that all officers perform such other duties as may be hereinafter provided.

ARTICLE IV.

It shall be the duty of the vice-presidents to assist the president in the performance of his duties and to officiate in his absence.

ARTICLE V.

It shall be the duty of the secretary to execute a good and sufficient bond, to be approved by the executive committee, to keep a correct record of the proceedings of each meeting of the association, and to keep an accurate account between the association and each of its members; to collect all moneys due the association and pay the same over to the treasurer, taking his receipt therefor, and to perform such other duties as may be hereinafter provided.

ARTICLE VI.

It shall be the duty of the assistant secretary to assist the secretary in the performance of his duties and, in his absence, to act in his stead.

ARTICLE VII.

It shall be the duty of the treasurer to give good and sufficient bond whenever required to do so by the executive committee, to be approved by the committee, to receive all moneys collected by the secretary belonging to the association, pass his receipt therefor, keep correct account of the same, and report minutely the financial condition of the association at each stated meeting, and to make disbursements of the funds of the association as hereinafter provided.

ARTICLE VIII.

The executive committee shall meet immediately after their appointment and confirmation and select their secretary. They shall hold their regular meetings on the last Monday in May, August, and November, and call meetings whenever called by the chairman. This committee shall have entire control of all business of the association, except during the time when in session. It shall have the power to appoint inspectors, agents, and representatives, and an assistant secretary if, in their discretion, such an officer shall be required, and shall fix salaries and compensations of all officers and employees of the association, shall offer rewards, and do any and all things which the association could do if in session, and its action shall be binding on the association. It shall audit all accounts of the association, and at each annual meeting make a report covering all matters requiring the attention of the association, and recommend such measures as it shall deem of importance for the action of the association. Any five members of the committee shall constitute a quorum, and their action shall be final, unless rescinded by two-thirds vote of the entire executive committee.

ARTICLE IX.

It shall be the duty of each member of the association to attend, as far as practicable, all meetings of the association and pay all dues and assessments that may be imposed; to make every endeavor to advance the interests of the association, or any one of its members, and the cattle interests generally, and to maintain a strict observance of all by-laws, rules, regulations, and resolutions, and to perform such other duties as are or may be hereinafter provided.

ARTICLE X.

Any person of age of 18 years or over, and owning or controlling cattle, shall be entitled to membership in this association after being elected as hereinafter provided. But no membership shall be continued in this association by any person who does not own or control cattle and render the same for assessment.

ARTICLE XI.

Any person eligible to membership in this association, as specified in article 10, and desirous of becoming a member, shall make application through the secretary, on blank form furnished by him, and be recommended by two members in good standing, and the initiation fee, as hereinafter provided, shall accompany the application. After the application has been made, the same shall be referred to the executive committee, whose duty it shall be to report to the association, with such recommendation thereupon as they may deem proper. Upon said report being received, the members shall immediately vote on the election of the candidate; and if an affirmative majority vote is declared, then the applicant shall take his seat as a member and be granted the privileges of the association; but no applicant shall be received who fails to render for assessment all cattle owned or controlled by him.

ARTICLE XII.

The initiation fee required to constitute a membership in this association shall be \$5, and each member shall also pay annually, in advance, \$5 as annual dues, all of which shall be paid to the secretary ("and the treasurer shall retain for the benefit of the association 10 per cent of the proceeds of all cattle caught at inspection points or otherwise and sold belonging to members of the association"); and should the business of the association demand it, an assessment shall be made pro rata, based upon the cattle owned or controlled by each member; provided, this assessment shall not exceed 2½ cents per head in any one year.

ARTICLE XIII.

It shall be the duty of the secretary to collect from the owner all pasturage paid by this association, or for which it has become liable, upon cattle belonging to members of this association and caught by inspectors of this association and held by such inspectors on pasturage.

ARTICLE XIV.

Votes cast for election of officers, on applications for membership, and on trial of members for violation of the laws of the association may be cast by ballot or otherwise as a majority of the members present may desire. Each member present must vote unless excused by the president.

ARTICLE XV.

It shall be the duty of each member of the association to make and file with the secretary a list of his brands and marks accompanying such brands, as nearly as possible, of all the cattle for which he asks protection, the number of said cattle to be not less than the number rendered by him for taxation and to include all other cattle owned or controlled by him, with the number of his cattle, his post-office address, location of ranch, etc., all of which shall be recorded by the secretary in a book kept for that purpose, and shall be open at all times for the inspection of members of this association.

ARTICLE XVI.

No member of this association shall render any brand to this association unless he owns or controls all the cattle in said brand.

ARTICLE XVII.

The secretary shall provide himself with all the books necessary for keeping the accounts, records, etc., of the association; also have all printing and advertising done necessary to be done in the interest of the association.

ARTICLE XVIII.

In purchasing the books specified in article 17, and such other stationery as the association may require, and in having printing and advertising done, the secretary may draw on the treasurer to pay for same. Vouchers must accompany his drafts for each purchase made.

ARTICLE XIX.

All disbursements and claims not provided for in article 18 must come before the executive committee in form of an account for allowance.

ARTICLE XX.

It shall be the duty of the secretary to notify each member of his indebtedness to the association quarterly, and any member refusing to pay his annual dues, or the assessment levied by the executive committee, or any portion of it, subjects himself to having his brands taken from the inspector's books and to a forfeiture of his right to protection and to having his name dropped from the roll of members.

ARTICLE XXI.

When a member of this association wishes to discontinue his membership in the same he must notify the secretary of such intention, and pay his indebtedness to the association up to the date of his withdrawal. On payment of such indebtedness the secretary shall furnish the member so withdrawing with an honorable discharge from the membership of said association; provided there are no charges against such member for violations of the by-laws, rules, and regulations of the association.

ARTICLE XXII.

The members of this association shall convene in annual session on the second Tuesday in March each year. At said meeting a majority vote shall determine the place for the next annual meeting.

ARTICLE XXIII.

Any member of this association who shall mark, brand, kill, or sell, or in any way appropriate for his own use or benefit any stock not his own, and without proper authority from the owner, shall be deemed guilty of an offense, and upon conviction, as hereinafter provided, shall be expelled from the association.

ARTICLE XXIV.

Any person who shall drive other cattle than his own from their accustomed range, thereby damaging the owner, will be guilty of violating the good intentions of the association, and on conviction, as hereinafter provided, shall be subject to expulsion, suspension, or reprehension, as the association or executive committee, by a majority vote, may see proper to inflict.

ARTICLE XXV.

Any member of this association, under indictment or other legal accusation of theft, may be suspended from the association, at the discretion of the executive committee, during the pendency of such accusation; and in the event of the conviction of any member of the association of the crime of theft, the executive committee may, at its discretion, expel such member from the association; provided, that all such cases of suspension or expulsion by the committee shall be subject to review, on appeal to the association, at its first annual meeting thereafter.

ARTICLE XXVI.

If any member of this association shall hereafter go on the bond of anyone indicted for the theft of cattle, unless it be a member or an employee of a member of this association, his name shall be taken from the list of members of this association.

ARTICLE XXVII.

It shall be the duty of each member, during a session of the association, to observe strict decorum, to avoid moving about, and all conversation or unnecessary noise

that might disturb the meeting in its deliberations; and when a member wishes to speak upon any subject he shall rise and address the president in a respectful manner, avoiding personalities and indelicate speeches; and when two or more arise at the same time, the president shall decide which one is entitled to the floor.

ARTICLE XXVIII.

It shall be the duty of any member knowing of any other member or members to have willfully and knowingly violated any of the by-laws, rules, and regulations of this association to prefer charges against any such member or members, as herein-after provided.

ARTICLE XXIX.

Any member wishing to prefer charges against any other member, as specified in articles 23 and 24, may appear before the executive committee and present either verbal or written charges against such member; and, if in writing, such charges and specifications shall be fully set forth and accompany the same. He shall present the names of such witnesses as he may wish to substantiate such charges, together with any other evidence he may wish considered. It shall therefore be the duty of said executive committee to consider said charges, and if it deem a trial necessary the said committee shall cause the secretary to summon the accused to appear, with any witnesses or other evidence he may have, at the next meeting of the association, there to stand trial upon such charges. But if upon consideration the said executive committee shall not deem a trial necessary, the accuser shall have a right to present his charges, together with such evidence as he may wish, before the association at its next ensuing meeting for its action upon the same; and if it be deemed that a prosecution be necessary, the secretary shall summon the accused for trial at the next ensuing meeting of the association in the manner hereinbefore stated.

ARTICLE XXX.

Whenever the executive committee shall be reliably informed by any member of the misconduct of any other member, and said information shall not have been presented in writing, it shall be the duty of said executive committee to cause an investigation into the truth of such charges, and if, in the opinion of the committee, the facts warrant it, the said committee shall cause the accused to be brought before the association for trial.

ARTICLE XXXI.

After charges have been preferred against a member in accordance with article 29, the prosecution shall be conducted by the accuser or his proxy and the defense by the accused or his proxy. The prosecution shall open the argument, the defense will follow, and then the prosecution will close, after which the members, with the exception of the accused and accusers or proxies, will ballot upon the guilt or innocence of the accused, and if a majority of the members present vote "guilty," then a ballot shall be taken as to the degree of punishment to be inflicted, commencing at the highest and descending to the lowest. The highest or first degree of punishment shall be expulsion, the second suspension, and the third reprehension; and a majority vote of the members present will be necessary to inflict punishment to any degree.

ARTICLE XXXII.

When a member is expelled he is not eligible to make application for new membership for a period of twelve months after expulsion, but if a member be suspended he shall remain accountable to the association for his conduct, yet is not entitled to any privileges as a member during suspension, but may be reinstated by making application before a stated meeting, and if a majority of the members present vote favorably upon his application, then he will again be entitled to membership.

ARTICLE XXXIII.

It is made the duty of any member of this association knowing of any person—whether a member of this association or not—marking, branding, killing, driving, milking, or in any way using or appropriating any cattle not his own, without proper authority from the owner, to report the same to the association, which hereby binds and obligates itself to prosecute all such offenders to the full extent of the law.

ARTICLE XXXIV.

Whenever any cattle are cut by an inspector of the association, the shipper shall lose the freight, unless he satisfies the inspector at the time that he has an understanding with the owner, or unless the shipper has reported the animal to the inspector or commission firm selling the same.

ARTICLE XXXV.

Whenever there is any dispute between members of this association as to the ownership of any animal held by an inspector of the association, they may submit such dispute to the executive committee at a regular meeting of the same upon their agreement to abide by the decision of said committee.

ARTICLE XXXVI.

No member of this association shall have the right to claim any animal through the association unless the same bears his brand, and the brand of the party from whom he claims to have purchased said animal shall not be considered his unless he has a written transfer of such brand.

ARTICLE XXXVII.

Members of this association will be required to furnish satisfactory proof of ownership to the secretary of this association on disputed claims for proceeds of cattle cut for them within ninety days after they have received notice of adverse claim, or the secretary will be authorized to disregard such claim. But in no case shall the secretary be authorized to turn over the proceeds of said cattle to either party until the expiration of ninety days, unless a decision has been made previous to this time by the executive committee, or the parties concerned agree to the ownership.

ARTICLE XXXVIII.

Order of business.

1. Reading of the minutes of last meeting.
2. Report of the executive committee.
3. Election of officers.
4. Receiving new applications for membership.
5. Unfinished business.
6. New business and resolutions.
7. Selection of place for next regular meeting.

ARTICLE XXXIX.

All amendments to these by-laws, rules, regulations, and resolutions shall be made in writing and submitted to the association at a stated meeting.

Utah Woolgrowers' Association.

CONSTITUTION AND BY-LAWS.

PREAMBLE.

For the purpose of protecting the industry of woolgrowing in this State; for the purpose of protecting the rights of persons engaged in this industry; for the purpose of maintaining the vested rights in the use of the common range which have been acquired by the woolgrowers; for the purpose of protecting ourselves against the enactment of laws which are designed to destroy our rights and crush our business, and for the purpose of preventing the spread of a public sentiment hostile to us and our welfare; for the purpose of urging upon Congress that just protection which we have been denied by laws heretofore enacted for the development of our industry, we, the undersigned, woolgrowers and dealers in wool in Utah, do make, ordain, and establish this constitution for ourselves as an associate body.

ARTICLE I.

The name of this association shall be "The Utah Woolgrowers' Association."

ARTICLE II.

The objects of this association shall be to carry into effect the purposes above set forth: to secure to the members, as far as possible, an equal participation in the benefits and in the work necessary thereto; to defend the individual members from oppression of any kind and to make a common cause of any injury or injustice inflicted upon a member; to protect the rights of the woolgrower in the use of the range, the water courses and springs, and his right to the use of the public highways; to provide a fund that can be used at any time in defense of our rights, or to prosecute to a final determination suits in the courts of law for any injustice which may be committed on members of this association.

ARTICLE III.

All persons who are engaged in the business of sheep raising or woolgrowing and all persons who are engaged in handling the wool clip of the State shall be eligible to membership in this association; but no person except a woolgrower shall be eligible to hold any office therein.

ARTICLE IV.

The officers of this association shall be a president, vice-president, secretary, and treasurer, and an executive committee. There shall also be elected a vice-president from each county in the State, whom the president may call in for consultation looking to the best interests of the woolgrowers.

ARTICLE V.

The executive committee shall consist of seven members, including the president, vice-president, secretary, and treasurer, who shall be ex-officio members of this committee.

ARTICLE VI.

The first regular meeting of this association shall be on the 6th day of April, A. D. 1896; the officers shall be elected by a majority vote of the members present, each member being entitled to but one vote. The term of office shall be one year, and until their successors are duly elected and qualified.

ARTICLE VII.

In case of a vacancy in any office the executive committee shall be empowered to fill the office by appointment until the next regular election.

ARTICLE VIII.

All applications for membership shall be made to the president of this association or to the vice-president of the county in which the applicant resides.

ARTICLE IX.

All voting for the admission of members or for the election of officers shall be by ballot.

ARTICLE X.

The regular meeting of this association shall be held in Salt Lake City annually on the 6th day of April. The regular annual election of officers shall be held at the annual meeting.

ARTICLE XI.

[Names of the first officers of the association inserted here.]

ARTICLE XII.

All amendments or changes to this constitution, or to the by-laws must be presented at a regular meeting of this association, and must be in writing. The proposed amendment or change shall be read at the meeting when presented, but no amendment or change shall be adopted unless two-thirds of the members present shall vote in its favor.

BY-LAWS.

SECTION 1. It shall be the duty of the president to preside at all meetings of this association or of the executive committee. He shall also perform such other duties as may be required of him by the laws of the association. He shall be ex officio a member of the executive committee.

SEC. 2. It shall be the duty of the vice-president to assist the president in the per-

formance of his duties, and in case of the absence or inability to act of the president, the vice-president shall preside at the meetings and perform all duties required of the president. He shall be ex officio a member of the executive committee.

SEC. 3. It shall be the duty of the secretary to record in a proper book all the proceedings of the association and of the executive committee. He shall write out the minutes of each meeting previous to the succeeding one, so that the same may be read thereat. He shall also notify members of their election, carry on the correspondence of the association, keep all papers and books, except those of the treasurer; collect all bills and assessments from the members, and pay over the amounts collected to the treasurer, taking his receipt therefor; make a report of all doings and acts of the association, including all the doings and acts of the executive committee at each regular meeting, and shall also perform such other acts as may be required of him by the laws of the association. He shall be ex officio a member of the executive committee, and shall receive such compensation for his services as may be voted to him by the association.

SEC. 4. It shall be the duty of the treasurer to receive from the secretary all monies collected, and to give a receipt to that officer for the same. He shall pay out money only upon warrants issued by the secretary and countersigned by the president, or upon warrants issued by four members of the executive committee, as hereinafter provided for. He shall keep an accurate account of all receipts and disbursements, and at the regular meetings of the association he shall give a detailed statement of all the financial transactions of the association and the executive committee. He shall be ex officio a member of the executive committee.

SEC. 5. The executive committee shall have general direction and supervision of all the work of the association. They shall hold meetings when necessary, at which meetings four members shall constitute a quorum to do business. All damages of whatsoever kind or nature, wrongs, indignities, extortion, or oppression done to or suffered by any member of this association shall be forthwith reported by the sufferer to any member of this committee, who shall immediately notify the president of this association. The officers and executive committee shall then examine into the cause of the complaint, and if, in their judgment, a wrong has been committed to the complaining member they shall forthwith take steps to right the wrong, and shall have power to commence a suit at law for that purpose, and to employ counsel therefor, or to defend a member in lawsuits brought against him wrongfully, and to employ counsel for that purpose; and for the carrying on and maintaining such suits and for the payment of counsel the president of this association shall draw warrants on the treasurer for the necessary funds, which said warrants must state the objects for which the funds are needed.

SEC. 6. Each member of the association who shall join during the year 1896 shall pay an initiation fee of \$1, and all persons joining this association afterward shall pay an initiation fee of \$1. Every member of this association shall pay a yearly due of \$1, provided he is not a sheep owner; but all members who are woolgrowers shall pay as yearly dues \$1 for every thousand sheep or fraction thereof which he may own. The yearly dues shall in all cases be paid each year during the fiscal year. The fiscal year shall commence October 6 and end October 6 of the following year. Any member who shall fail to pay his yearly dues as above provided shall forfeit all rights to the protection offered by this association.

SEC. 7. The secretary and treasurer shall give bonds, with two good and sufficient sureties, the eligibility of whom shall be in accordance with the laws of the State of Utah, to the president, which bonds shall be subject to his approval, the secretary in the sum of \$1,000 and the treasurer in the sum of \$1,000.

SEC. 8. The regular meetings of this association shall be held in Salt Lake City, as provided in the constitution. Special meetings of the association may be called at any time by the president at his discretion, or on the written request of not less than five members of the association. At any regular or special meeting 25 members shall constitute a quorum to do business.

SEC. 9. At all meetings of the association the order of business shall be as follows:

1. Calling roll of officers.
2. Reading of minutes.
3. Reading of communications.
4. Reports of officers.
5. Reports of special committees.
6. Reports of standing committees.
7. Unfinished business.
8. New business.
9. Election of officers.
10. Miscellaneous.
11. Adjournment.

(Concluded from page 2 of cover.)

- | | |
|---|--|
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U. S. DEPARTMENT OF AGRICULTURE,

BUREAU OF ANIMAL INDUSTRY—Bulletin No. 65.

D. E. SALMON, D. V. M., Chief of Bureau.

THE
POULTRY AND EGG INDUSTRY OF LEADING
EUROPEAN COUNTRIES.

BY

ANDREW FOSSUM, Ph. D.,

Editorial Office, Bureau of Animal Industry.



WASHINGTON:

GOVERNMENT PRINTING OFFICE.

1904.

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[Continued on 3d page of cover.]

U. S. DEPARTMENT OF AGRICULTURE,

BUREAU OF ANIMAL INDUSTRY—Bulletin No. 65.

D. E. SALMON, D. V. M., Chief of Bureau.

THE
POULTRY AND EGG INDUSTRY OF LEADING
EUROPEAN COUNTRIES.

BY

ANDREW FOSSUM, Ph. D.,
Editorial Office, Bureau of Animal Industry.



WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1904.

LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF ANIMAL INDUSTRY,
Washington, D. C., September 27, 1904.

SIR: I have the honor to transmit herewith an article dealing with the poultry and egg industry of leading European countries, by Dr. Andrew Fossum, of the Editorial Office of this Bureau, and to recommend its publication as a bulletin. The special feature of this article is the full description of the methods of producing and marketing eggs in Denmark, by which that little Kingdom is able to secure a constant foreign trade at high prices.

Respectfully,

D. E. SALMON,
Chief of Bureau.

Hon. JAMES WILSON,
Secretary.

CONTENTS.

	Page.
Introduction	5
Denmark	6
Numbers of poultry	6
The export and import trade.....	7
Foreign eggs in Denmark	9
Imports and exports of poultry.....	10
Poultry and egg societies in Denmark	10
Great Britain	22
Numbers of poultry	22
Why egg production has decreased	22
Importation of eggs.....	23
Poultry societies	24
Per capita consumption.....	24
Imports of poultry	24
Ireland	25
Work of the congested districts board.....	25
Cooperation established	28
The Irish Agricultural Organization Society	29
Transformation due to poultry societies	33
Instruction in poultry keeping	34
France	38
Geographical distribution of poultry.....	38
The conditions of production.....	39
Method of collecting eggs at St. Malo	41
Production and consumption of poultry	41
The possibilities of improvement	42
Imports and exports of poultry.....	42
French exports of eggs.....	43
Live and dead poultry	49
Pâté de foie gras.....	50
Consumption of eggs in Paris.....	51
Italy	55
Germany	58
Austria-Hungary	60
Netherlands	63
Belgium	64
Russia.....	64
Appendix I.—Rules governing the Society for Poultry Breeding in Denmark..	67
Appendix II.—Rules of the Society for the Promotion of Poultry Breeding in Denmark	71
Appendix III.—Rules of the Society for Profitable Poultry Breeding.....	73
Appendix IV.—Rules governing the Danish Cooperative Egg Export Society.	74

THE POULTRY AND EGG INDUSTRY OF LEADING EUROPEAN COUNTRIES.*

By ANDREW FOSSUM, PH. D.,
Editorial Office, Bureau of Animal Industry.

INTRODUCTION.

It is necessary only to glance at the imports and exports of eggs for the leading countries of Europe to understand the place that the egg trade now occupies in the commerce of the world. Rapid transportation has made it possible to ship this perishable article to distances unthought of before. So it has come to pass that eggs, which used to be consumed where they were produced, now form an important part of the food supply of our large cities. With Germany and England, respectively, importing eggs in 1902 valued at \$27,386,898 and \$30,702,575, it shows that the time is past when we should consider this an infant industry, and it is destined to expand greatly in the near future.

A perusal of this article shows that the consuming countries, as shown by their enormous imports of eggs, are the United Kingdom and Germany. Both of these great countries are increasing their consumption every year if one may judge from the imports. For instance, the imports into the United Kingdom, which in 1871 were valued at \$6,149,368, increased fivefold by 1902. In Germany the imports increased in value from \$17,103,108 in 1895 to \$27,386,898 in 1902.

The conspicuous position that Denmark now occupies in the European egg trade has called attention to the methods followed in the development of its poultry industry. Denmark was the first country to develop and perfect the system now in vogue in that country, and the principles have proved so sound that several other countries have followed in her steps.

The success of the enterprise has been so complete, both in Denmark and in other countries that have tried it, that the people of the United States can hardly afford to overlook it any longer. This industry in

* From the nature of the subject in hand the official documents have been indispensable in preparing this report. The author has used freely whatever has suited the purposes of this report in Danish, English, French, and German publications, and it would hardly be possible to give due credit in every instance to each document. As regards Denmark, thanks are due to the following persons, who have furnished valuable data: Hr. J. Kornerup, Aarhus; Hr. Anton Thomsen, Terpling ved Holsted, and Hon. Raymond R. Frazier, United States consul at Copenhagen.

America is extensive, but it lacks organization to such an extent that in spite of the great production our large cities are paying famine prices for an inferior article. Organization along the lines followed in Denmark would be in the interest of the producer and consumer alike. The producer would obtain better prices and the consumer would obtain guaranteed fresh eggs of full weight.

England, which is the center of the European trade, is too remote to furnish a large opening for eggs from this side of the Atlantic so long as the conditions obtaining here continue. But the large cities upon the Eastern seaboard and in the interior of the country should, with better organization, be more profitable markets than any foreign market.

DENMARK.

NUMBERS OF POULTRY.

The earliest census of poultry took place in 1888. Since then there have been two censuses—one in 1893 and another in 1898. The table below shows the reports for these three years:

Numbers of poultry in Denmark in 1888, 1893, and 1898.

Year.	Chickens.	Turkeys.	Ducks.	Geese.
1888	4,592,000	32,000	644,000	214,000
1893	5,856,000	41,000	724,000	230,000
1898	8,767,000	52,000	808,000	211,000

It appears from this table that chickens, turkeys, and ducks have increased in number in the years between 1888 and 1898, while geese have decreased. This seems to be owing to the greater profitableness of the former.

As a rule, chickens are not kept separately, but in connection with other agriculture. Poultry is kept on all farms. But it is evident that the importance of keeping poultry is greater for the small than for the large farms, as the former lack other sources of income.

In 1895 there were in Denmark 236,860 farms and small holdings.^a According to the poultry census of 1898, there were 37 chickens on the average to the farm or holding. Distributed according to the acreage, Denmark has an average of 0.92 chicken to the acre. We should not lose sight of the fact that poultry keeping may be conducted with a small capital, and that in consequence of this it is possible for the poorest classes to go into it with promise of profitable returns.

^a Statistisk Tabelværk, Fjerde Række, Litra C. Nr. 9 Danmarks Jordbrug den 1ste Januar 1895.

THE EXPORT AND IMPORT TRADE.

The earliest statistics of the exports of eggs from Denmark proper go back to 1861, while the imports begin three years later, being counted for the first three years with those of Schleswig-Holstein and the Lubeck and Hanseatic Enclaves.

A table showing the imports and exports of eggs for the period 1861 to 1902 is given herewith:

Danish imports and exports of eggs, 1861 to 1902.

Year.	Imports.		Exports.	
	Quantity.	Value.	Quantity.	Value.
	Dozens.	Dollars.	Dozens.	Dollars.
1861.....			13,707	
1862.....			16,745	
1863 ^a			24,790	2,987
1864-65.....	858		43,257	
1865-66.....	3,385		58,080	
1866-67.....				
1867-68.....	3,862		51,378	
1868-69.....	3,242		44,352	
1869-70.....	4,158		53,950	
1870-71.....	43,690		93,420	
1871-72.....	12,370		574,215	
1872-73.....	29,273		1,149,232	
1873-74.....	68,063	9,121	2,378,070	318,676
1874 ^a	38,125	5,395	1,972,697	279,145
1875.....	23,557	3,987	2,658,440	451,126
1876.....	117,237	19,129	2,328,888	382,712
1877.....	108,038	17,025	1,573,949	248,026
1878.....	94,750	13,819	2,001,622	296,112
1879.....	85,427	12,500	2,183,677	319,523
1880.....	135,305	19,581	3,320,092	520,483
1881.....	140,908	21,411	3,100,122	467,083
1882.....	296,357	31,640	3,983,408	616,774
1883.....	408,728	64,120	4,690,463	795,748
1884.....	424,678	63,242	6,071,870	904,204
1885.....	207,285	30,900	6,040,800	900,451
1886.....	173,658	24,188	7,752,618	1,080,072
1887.....	310,958	42,597	9,246,208	1,256,368
1888.....	738,078	96,386	8,389,437	1,236,236
1889.....	948,705	139,108	9,731,440	1,457,626
1890.....	1,705,223	276,942	11,143,255	1,541,754
1891.....	1,815,423	293,088	11,949,838	1,809,754
1892.....	1,768,080	264,547	13,232,140	1,933,220
1893.....	1,566,460	270,249	11,711,318	2,183,687
1894.....	1,422,673	211,837	13,250,073	2,020,464
1895.....	2,087,960	318,203	13,175,318	2,258,704
1896.....	2,296,617	343,835	16,375,873	2,764,902
1897.....	2,589,558	365,112	20,752,755	3,514,910
1898.....	2,146,977	312,690	22,290,902	3,668,353
1899.....	2,248,628	318,062	25,248,703	4,488,464
1900.....	3,098,830	403,440	27,646,617	4,870,096
1901.....	5,275,563	499,281	31,866,192	5,734,128
1902.....	4,587,760	678,576	36,103,125	6,527,944
1903.....			42,500,000	68,092,000

^a The figures for this year are for all of 1863 and the first three months of 1864. After March 31, 1864, to 1874, the year ended on March 31; the year of 1874 is therefore shortened to nine months.

^b Preliminary figures.

In treating of the exports of eggs from Denmark from 1861 up to the present time the general movements only are considered that have manifested themselves in the course of a series of years, and the minor fluctuations discarded that result from cold and unfavorable seasons or from the demands of temporary markets. The exports of 1861 were 13,707 dozens, and, although not the first, are plainly small enough to be considered the beginning. The exports of the first ten years are rather erratic, and show an uncertain condition of supply, but there is a general tendency toward increase.

During the next ten years the exports rose from 574,215 to 3,100,122 dozens. What contributed more than anything else to the increasing regularity in the exports of eggs was the fact that Denmark now found a large and steady market in England. Before this, Norway had been the chief customer, using Danish eggs chiefly to provision her large merchant marine; but in 1871 England took the lead, which she has ever since held, in buying Danish eggs. Beginning with the purchase of two-thirds of the Danish exports of eggs in 1871, England has always been the largest buyer and often taken nearly the entire supply. The Danes soon found it to their interest to win the good will of this great customer, and have systematically labored to improve the quality of the supply.

In the decade 1881 to 1890 we notice considerable improvement. The exports rise from a trifle under 3,100,122 to 11,143,255 dozens. The increase, moreover, is more steady and regular, and averages about 800,000 dozens a year for the decade. To this period, it will be remembered, belongs the rise of several poultry societies which helped to create and maintain a stronger interest in this industry.

The Danish Cooperative Egg Export Society came into the field in 1895 and brought life and vigor into the industry, and soon the exports rose by leaps and bounds, increasing at the average rate of 3,333,333 dozens a year. The Danes were already familiar with the workings of the cooperative system in other lines and now decided to apply its principles for the first time to the egg trade. They knew that they could not obtain better prices for their eggs so long as some of them continued to sell bad and dirty eggs, and that, as a matter of self-protection, it was necessary to oblige all who shipped under a common trade-mark to guarantee their products. In this way only could they compete in the best markets and obtain the highest prices. The egg trade is one of the industries to which the cooperative principles can be best adapted, and, one might even add, the one without which success is only possible under exceptional circumstances. Nothing can better demonstrate the correctness of the Danish views than the success which attended the undertaking. Instead of being the cheapest, Danish eggs now rank with the highest in the British market; and instead of exporting a few million dozens, as we might expect from a

small agricultural country, Denmark outranks all European countries, when the size of territory and population are taken into consideration. While Denmark in 1902 exported eggs valued at \$6,527,944, Germany, with an area more than fourteen times greater, imported eggs in the same year to the value of \$27,387,058.

The table below gives for 1900 the imports and exports of eggs for several countries and their percentage per capita:

Value of imports and exports of eggs and per cent per capita of population, 1900.

Country.	Imports.		Exports.	
	<i>Dollars.</i>	<i>Per cent.</i>	<i>Dollars.</i>	<i>Per cent.</i>
France	3,408,579	0.09	2,895,545	0.08
Germany	24,061,090	.43	140,082	.002
Italy	65,190	.002	9,656,840	.30
Russia			15,835,214	.15
Austria-Hungary	5,563,155	.12	20,150,285	.45
Belgium	1,962,424	.30	1,505,979	.23
Holland	1,074,802	.21	655,470	.13
England	26,308,396	.71		
Denmark	423,440	.17	4,852,676	1.98

The increase in the egg export has been so great as to change its relative position with regard to other items of export. The table of values below shows that eggs occupied the fifth or sixth place in 1878 and the third place in 1901:

<i>Exports in 1878.</i>		<i>Exports in 1900.</i>	
Butter	\$7,906,000	Butter	\$35,456,400
Cattle	5,876,400	Bacon	22,214,000
Horses	1,715,200	Eggs	5,681,600
Bacon and meat	1,527,600	Meat	3,108,800
Eggs	321,600	Horses	3,082,000
		Cattle	2,224,400

FOREIGN EGGS IN DENMARK.

The imports, like the exports, have steadily grown. From a few thousand dozens in the "sixties" they have risen to over 4,000,000 dozens in forty years. Sweden and the former Danish provinces (Schleswig-Holstein and Lauenburg) used to be the principal sources of the supply, till Russia supplanted them during the last decade. Nearly all the eggs imported into Denmark go into home consumption, only a small fraction entering into the reexports. The transit trade, which figures so largely in some countries, is here very small. The imports did not reach the 100,000-score mark (score=20 eggs) till the early "eighties." Beginning with 1890 they have remained for ten years at about 1,000,000 scores, and in the last three years have doubled. As Danish eggs bring a high price and are in demand, it is more profitable to sell their own product and to supply some of the home demand by imports from abroad. Foreign eggs, at the same time, being com-

paratively fresh on their arrival in Denmark, would become rather old when they reached the British consumer.

IMPORTS AND EXPORTS OF POULTRY.

A table giving the imports and exports of poultry shows that the former have far exceeded the latter during the last eighteen years:

Danish imports and exports of poultry, 1885 to 1902.

Year.	Imports.		Exports.		Year.	Imports.		Exports.	
	Number.	Value.	Number.	Value.		Number.	Value.	Number.	Value.
1885.....	56,409	\$56,238	2,102	\$2,453	1894.....	139,127	96,944	2,119	2,091
1886.....	21,096	18,770	1,801	2,027	1895.....	146,233	101,503	4,835	4,632
1887.....	13,253	11,792	1,790	2,015	1896.....	82,151	53,940	4,075	4,041
1888.....	15,917	14,145	1,449	1,631	1897.....	70,384	56,569	1,546	1,657
1889.....	104,285	92,677	886	997	1898.....	57,373	47,936	1,420	1,522
1890.....	79,696	70,827	2,197	2,473	1899.....	49,078	35,396	2,800	2,948
1891.....	149,286	104,663	2,298	2,039	1900.....	21,905	17,608	3,897	4,636
1892.....	100,095	70,175	1,871	1,856	1901.....	54,019	43,443	3,701	4,956
1893.....	142,020	97,008	2,476	2,356	1902.....	36,491	29,668	6,081	7,879

POULTRY AND EGG SOCIETIES IN DENMARK.

The fact that so many poultry societies lead a perfunctory life and exist only on paper might lead one to overlook their importance. But what poultry societies can accomplish in spreading information and inculcating rational methods in the industry, we may learn from the history of the poultry societies in Denmark. In that country we can trace back to the societies the influence that elevated the industry from the low estate in which it was before reaching the rank it now occupies. The societies, with intelligent men at their head, led the way. As it was the societies that made the improvements and brought about the exceptional conditions that now obtain in this industry in Denmark, it will be worth our while, in order to understand the progress that has been made, to discuss at some length the history of these societies. The purpose of a few of these following pages will be to give an account of the history of the different societies that have contributed to the remarkable development of this industry. At the same time the purpose has been maintained to give all information obtainable about the poultry organizations in other leading European nations, together with a full record of imports and exports of poultry and eggs.

HISTORY OF THE DANISH POULTRY SOCIETIES.

SOCIETY FOR POULTRY BREEDING IN DENMARK.^a

HISTORY AND DEVELOPMENT.^b

The first impulse tending to better organization in poultry raising as well as in several other industries came from Consul-General Hen-

^a For rules, see Appendix I, p. 472; for by-laws, p. 474.

^b A comprehensive sketch of these societies appeared in the quarter-centennial number of *Tidsskrift For Fjerkræavl*, Aarhus, June 16, 1903.

drik Pontoppidan, a man held in great esteem in Denmark for his broad and high-minded patriotism. In June, 1878, a small but enthusiastic party met on his estate, Constantinsborg, near Aarhus, to consider in an informal way what could be done to improve the condition of the poultry industry. After a preliminary meeting they organized a society at Aarhus on November 30 of the same year. That there was genuine interest in the enterprise appears from the fact that forty speakers listed for the occasion did not exhaust the fund of enthusiasm. The society adopted the name "The Society for the Promotion of Poultry Breeding, Especially of Chicken Breeding and Egg Trade." As the meeting declared, the object was to be attained by discussions, lectures, exhibits, and pamphlets; by giving advice and information in matters pertaining to poultry breeding; by supplying the farmers with breeding animals and sitting eggs; by building a model poultry run, and by furthering the interests of the industry in every way that the directors might deem expedient. It also assists local societies in their exhibits by giving advice, lending cages, selecting judges, and offering prizes. The same meeting adopted a series of rules, or laws. According to these the practical management is in the hands of the directors, while the final authority is in the general meeting. To keep in touch with all the members, scattered over the whole country, each town or district having ten members sends one delegate to the annual meeting. To be within the financial reach of the small farmers, the annual fee is 2 kroner (53.6 cents). The officers were able and enthusiastic men. Such was the organization of this society, the first of its kind not only in Denmark but in all Europe.

Pamphlets sent to all parts of the land stirred up a lively interest in the undertaking by calling attention to the neglect in which the industry found itself, and its importance in France and elsewhere. It would prove an important source of income to all, and not least to the small farmers and tenants.

From small beginnings the society has grown in numbers and importance. The membership at the time of the first general meeting was 600; in 1891 there were 2,373 members, and in June, 1903, 3,456. The standing that the industry enjoys appears from the fact that a baron is its president and the crown prince its patron.

The following table shows the number of members every three years from 1879 to 1903:

1879	1,351	1894	2,268
1882	2,600	1897	2,900
1885	2,754	1900	3,124
1888	2,489	1903	3,456
1891	2,373		

It soon became evident that it was necessary to publish a periodical in order to reach all the members. The first general meeting, March,

1879, agreed to this, and the first number of the paper appeared March 10 of the same year. Georg Bricka was the first editor, and he continued in that capacity till the end of 1901, when he was succeeded by Fr. Hansen, the present editor. Georg Bricka was a great worker and a man of extensive information. Besides writing at times the entire issue of the journal, he wrote several books on poultry breeding—one of them the largest in the language. He was a member and for ten years president of the parish council, teacher in the grammar school of Fredericksborg, musical leader in his town of Aarhus, and judge of poultry exhibits and prize compositions. He continued to be the editor till the end of 1901, when he died. By private subscriptions the society erected a monument to his memory the following year. A man of his energy and sound character was sure to make a lasting impression upon the society, which developed on broad and sound principles. The journal is free to the members of the society, but the outlay in maintaining it is many times repaid by the influence it exerts in holding the members together and in furthering the cause it represents. "For many members," as the president, Baron Rosenkrantz, wrote to Bricka, "the journal is the society. They do not join or withdraw from the society, but subscribe to or discontinue the paper."

This new industry had appeared at the right moment, and it was only necessary to find some means of spreading information in order to advance the cause. They had to hit upon the right kind of information and how to spread it effectively among the peasants. At first the society made use of Bricka's Brief Guide, but in 1890 adopted Fenger's Brief Directions in Poultry Breeding, which in a few pages gives the fundamental principles of practical poultry keeping.

At first these pamphlets were sent to school teachers for distribution, but the promoters soon satisfied themselves that this was not the best method and abandoned it. Since then the society has distributed over 60,000 copies through the farmers' credit associations, and in more expensive bindings as prizes to those who drew "blanks" at the exhibitions.

Poultry shows should not be underestimated. Shows are as important in this as in the other lines of animal industry. They allow the members an opportunity to compare the results of their work, and thereby check and correct excesses and give a healthy direction to the industry. Then they serve as excellent places of exchange. Financially, they have usually shown a deficit, but in view of the general benefit done by them the society has, nevertheless, given twenty-eight shows during the twenty-five years it has existed.

The first exhibition of poultry occurred at Aarhus June 27 and 28, 1878. The members exhibited 213 birds. Of the purebred birds the Spanish were best represented. About 4,000 people visited the exhib-

its. It has been encouraging to note that greater interest in the work has always manifested itself in the locality where an exhibition has been held, and for this reason they hold their annual exhibitions first in one place and then another. They have been held in twenty-one different places since 1879. The one at Odense in 1900 exhibited 1,020 birds, but the largest and most striking was the quarter-centennial at Aarhus in 1903.

When this poultry society came into existence Danish eggs were small and held in low esteem in the British market. Many farmers kept back their product waiting for better prices, and the English complained that as soon as the price rose every case from Denmark contained pickled and spoiled eggs. In Denmark a score of small eggs brought as much as so many large ones, and it was too much to expect the farmers to make any sacrifice without a corresponding advantage. As a rule, they consumed the large ones and sold the rest. The society worked for an improvement by introducing the custom of buying and selling eggs by weight and not by number. The result was that a dozen large ones would bring a higher price, both on account of their size and weight. Although the English still handled eggs by the dozen, they paid more for large ones. In 1880 the directors entered into negotiations with the large egg dealers with the end in view of purchasing eggs by weight. These favored the idea and were willing to make a change, provided other dealers would do the same. Under these circumstances progress was slow, and years passed before they brought about the present condition of things, which is that the export trade is by weight. How far the Danes were in advance of the rest of the world appears from the fact that the Berlin authorities only last year recommended the use of weight in the egg trade, and some great nations still cling to the antiquated method of marketing eggs by the dozen.

In order to bring about an increase in the size of the eggs it was necessary to obtain better breeds of chickens, but no one knew as yet what kinds would adapt themselves to the country. To ascertain how they would thrive they distributed in 1880 to fifty persons in different parts of the country six hundred sitting eggs of purebred chickens on the condition that the recipients should report on the experiment in the fall. In the following year they sent out more eggs, and in 1883 postal cards with printed forms accompanied the eggs. It was found impossible in many cases to protect the eggs during transmission, and, as only a few reports were made, the plan was abandoned in 1885. An attempt to distribute pure stock proved almost equally unsuccessful.

The society had abandoned the plan of maintaining a model poultry farm in 1882 as being too expensive; but now, having stopped the distribution of eggs, they decided to distribute purebred chicks. As in the case of eggs, the poorer classes had the preference, and

could also to a certain extent choose the breeds they desired. The condition was that they report the results. There was less inconvenience regarding the reports, and altogether this method proved to be the most satisfactory, and contributed more than any other to improve the poultry breeds in the land. As many complaints were made of defects in the fowls sent out, the society decided to gather and inspect all chicks at Aarhus before making the distribution. This was expensive, but necessary, and permitted an exchange of cockerels.

At first the society sent out Italians and Minorcas in accordance with a plan that the latter, being less hardy, were distributed over the Islands and the former in Jutland. The society began to distribute specimens of the native kind in 1890, and has since experimented with other breeds. They distributed annually thirty-three birds at first, but since 1889 they have distributed as shown in the following table:

Distribution of poultry in Denmark, 1889 to 1902.

Year.	Young pullets.						Young cockerels.					
	Ital-ians.	Minor-cas.	Danish.	Orpingtons and Lang-shans.	Ply-mouth Rocks.	Total.	Ital-ians.	Minor-cas.	Danish.	Orpingtons and Lang-shans.	Ply-mouth Rocks.	Total.
1889.....	17	6	.....	.....	.....	23	.....	.....	.....	.....	.....	.....
1890.....	17	10	3	.....	.....	30	.....	.....	.....	.....	.....	.....
1891.....	20	1	5	.....	.....	26	.....	.....	.....	.....	.....	.....
1892.....	12	8	4	.....	.....	24	.....	.....	.....	.....	.....	.....
1893.....	17	8	.....	.....	.....	25	.....	.....	.....	.....	.....	.....
1894.....	14	6	5	.....	.....	25	.....	.....	.....	.....	.....	.....
1895.....	17	8	5	.....	.....	30	.....	.....	.....	.....	.....	.....
1896.....	31	12	3	.....	.....	46	.....	.....	.....	.....	.....	.....
1897.....	9	10	2	4	.....	25	7	3	.....	2	.....	12
1898.....	11	11	3	.....	.....	25	2	5	1	.....	.....	8
1899.....	11	10	2	2	.....	25	3	4	.....	1	.....	8
1900.....	7	8	3	.....	4	22	5	.....	.....	.....	.....	5
1901.....	13	4	.....	.....	8	25	3	3	1	.....	2	9
1902.....	10	9	1	.....	5	25	11	4	1	.....	5	21

The native poultry, by long and unsystematic crossing, had degenerated to such a degree that many despaired of finding the original stock. "It was seldom possible," we read in a poultry journal of 1880, "to find the Danish breed in a pure state." But a few isolated breeders had faith in the breed and hoped to restore it by careful selection. It possessed the advantage of being hardy and contented and perfectly adapted to the climatic and other conditions of the country. This breed is a fair layer, producing eggs the size of those of Wyandottes. A score weighs about 2.3 pounds. The cock is red and black and the hen is buff colored. Societies for the development of this breed sprang up in 1888, and finally in 1900 the three leading poultry societies agreed upon a standard whereby it could be recog-

nized. About this time special clubs or associations were formed for the purpose of improving the different breeds of poultry—Italians, Minorcas, Danish, etc. The object was not so much to make money as to bring out and perfect the best qualities of the breed and thus ultimately to make them more profitable to the country.

We have already seen that a lack of funds prevented the society from realizing its original plan of maintaining model poultry runs. Since 1893 experimental stations have been established—the first one at Aarhus for the native Danish breed and one at Copenhagen for the partridge-colored Italians. After receiving a state aid of 6,000 kroner (\$1,608) a year, the society has maintained six more stations—two for White Italians, one for Plymouth Rocks, one for Wyandottes and partridge-colored Italians, and one for Minorcas. The society has also awarded prizes for compositions on numerous subjects. This work is of a practical nature and has been of great benefit to the country.

GOVERNMENT.

According to the original draft of the constitution in 1878, the practical management of affairs was in the hands of the directors, while the final authority rested with the general meeting, consisting of representatives assembling annually. The meetings were held in different places each year, and it occurred that the locality where the meeting was held was so strongly represented that the resolutions hardly failed to be an expression of the local rather than of the general sentiment. Hoegh-Guldberg had called attention to this unfortunate condition in 1880, and two years later a change was made. Henceforth each district sent two delegates to the meeting of deputies. These in turn elected a president for three years and four directors for two years, who constituted the executive committee. The secretary-treasurer may be chosen outside the directorate. Thus all the counties were equally represented, but so long as each delegate had to pay his own expenses few came to the meetings; in 1887 only 14 appeared. So a change was made in that year. Thirty-eight representatives—2 from each county—replaced the former delegates. One-half of the delegates retired each year. They had the choice of their own successors as well as of the directorate, which now consisted of 11 members—5 from Jutland, 2 from Fyn, 3 from Sjaelland and Bornholm, and 1 from Lolland-Falster. The directors chose their own officers and the executive committee. Thus outside members had no influence. From being entirely democratic in the beginning the society had become oligarchic in form. That this continued without opposition for ten years is a tribute to the fairness and the ability of the governing body; and it was a mark of the confidence of the members that when a democratic change took place only three societies availed themselves of the privilege of sending representatives the first year.

Centralization now approached the danger line, and it was the part of prudence to work in the opposite direction and develop independent local associations. Fortunately, in 1887, the poultry society of Hjørring had applied for admission as an affiliated society. This was a fruitful suggestion, and prompted the society to admit others of that kind and to encourage the formation of district societies and other organizations with the purpose of admitting them in time as affiliated societies. These paid no fees, but simply pledged a certain number of their members to the head society and received in turn a corresponding number of copies of the society's periodical and the society's aid in organizing exhibitions. In 1897 it was agreed that the counties should each henceforth elect two representatives. Finally, in 1902, a new constitution was adopted embodying further changes in this direction. Accordingly there are now 20 districts, each sending 2 representatives—their president and vice-president—to the general meeting. The meeting, as a rule, is to be held in connection with the annual exhibition and is open to all members, but only representatives, directors, and honorary members can vote. The directors are 7 in number—3 from Jutland, 1 from Fyn, 2 from Sjaelland and Bornholm, and 1 from Lolland-Falster. The president, vice-president, and secretary constitute the executive committee.

SOCIETY FOR THE PROMOTION OF POULTRY BREEDING.^a

Two new societies, after the pattern of the original one, sprang up in Copenhagen in 1880 and 1882, respectively. This was unfortunate and threatened to break up the country into small societies (as in Saxony, where 100 societies existed at this time without any central organization) and waste its energy in useless rivalry. Union was especially important now that they purposed to take the lead in this industry and distance all foreign competition. Consequently the leaders left no stone unturned in order to live in harmony, and a committee of two from each society undertook to see that they should not clash at any point. In 1889 the two Copenhagen societies combined, and in 1891 the Society for Poultry Breeding in Denmark and the Society for the Promotion of Poultry Breeding (Copenhagen) joined and adopted the name The Danish Poultry Society, with headquarters at Aarhus. The general government consisted of 5 directors—2 chosen by the Copenhagen branch and 3 by the Aarhus branch. One-third of the state aid was to go to the general government and the remainder to the two societies, in proportion to their membership. The one branch should not hold an exhibit in the country nor the other hold one in Copenhagen. Now all interests were harmonized and the work could go on unhindered.

^a For rules, see Appendix II, p. 476.

POULTRY AND EGGS IN EUROPEAN COUNTRIES.

SOCIETY FOR PROFITABLE POULTRY BREEDING.^a

Now that poultry keeping had become remunerative a new tendency appeared. People began to consider more closely the profits of poultry raising and to look upon the breeding of fancy birds as a separate branch of the industry. A society representing this tendency came into existence in 1897 and grew so rapidly as to rival the older societies in membership. The name of this society is Society for Profitable Poultry Breeding. The real leader in this movement was J. Pedersen-Bjergaard, who edits the Poultry Yard, the paper of the society. Attempts to combine this society with the others under a common government have so far proved unsuccessful. The minister of agriculture favors a union among all the societies, in the hope that this will best subserve the general welfare.

In 1903 the societies had the following membership: Society for Poultry Breeding in Denmark, 3,700; Society for the Promotion of Poultry Breeding, 2,000; Society for Profitable Poultry Breeding, 3,000; total, 8,700.

DANISH COOPERATIVE EGG EXPORT SOCIETY.^b

The Cooperative Egg Export Society was founded at Vejle, in Jutland, in 1895, but has since 1900 been located at Copenhagen.

The real purpose of this society is to market the products of the poultry societies. Its work commences where the other societies leave off, and supplies an essential link necessary to complete their financial success. It works in harmony with them and attracts the same membership, although it is an independent organization. A great drawback to a successful export trade had been the fact that producers as well as dealers withheld their eggs for higher prices, and that in consequence they were often a month old when they reached England. The grocers and dealers themselves were the first to see the need of a reform, and as early as 1890 attempted, without success, to form an association to stop this practice. In order to hasten the transportation of eggs one of the poultry societies appealed to the ministry of the interior to have eggs considered perishable goods, but this was not granted till 1897.

How thorough and far-reaching the reforms of the Danish Cooperative Egg Society were appears from the fact that the dealers and grocers strongly opposed the new organization, as it went far beyond the plans contemplated by them, but the rapid growth of the society and the success of the enterprise, satisfying a long-felt need, was strong enough to overcome all opposition.

According to the most recent reports there are altogether some

^a For rules, see Appendix III, p. 478.

^b For rules, see Appendix IV, p. 479.

33,500 members distributed among 475 local societies or circuits. The conduct of all the affairs of the society is in the hands of a council of five directors, who also, on the basis of market quotations, fix the price of eggs paid to the members. Each circuit must have at least ten members. The general meeting, consisting of delegates from the circuits, prescribes a series of uniform by-laws for all the circuits, allowing only slight deviations to be made by the circuits.

The circuit pays the society half a krone (13.4 cents) for each member and one-half of all the fines collected. The circuit elects a local council of its own, hires an egg collector, supplies all the funds necessary to pay for the eggs and for defraying the expenses till the eggs are ready for shipment from the circuit. At this point the society takes charge, paying the expenses till the eggs are on board the ships for foreign export and deducting the costs from the general profits. At the close of the financial year, after settling all the accounts, the society pays one-half of the profits to the circuits and credits the remainder to the circuits. This sum is to be used to carry on the work, and can be paid over to the circuits only at the final dissolution of the society, unless in the judgment of the directors the amount exceeds the requirements of the business.

The government of the circuit, just as that of the society itself, is a directorate consisting of an uneven number of members and elected by the circuit. The duty of the directors is to look after the interests of the circuit, and to see that the eggs are delivered promptly and in the condition required. They hire the egg collector and the other employees of the circuit; they also fix the daily price paid for eggs by the collector.

Every circuit has a central station situated, if possible, on a through railway or steamship line connected with one of the shipping stations of the society. It has an office and rooms for storing and packing the eggs delivered by the members. It is the meeting place of the directors and members of the circuit.

Each circuit has an egg collector who gives satisfactory bonds for the honest discharge of his work. The collector goes from farm to farm on stated days and takes the eggs to the station in the evening. The farmers must not deliver eggs that are more than seven days old or that were laid before the last collection took place. The eggs must be clean and be stamped with the number of the member who furnishes them. The collector refuses dirty eggs, and stamps them to prevent their being washed and presented a second time. The eggs are bought by weight regardless of their size. The payment is in cash and at a price fixed by the directors of the circuit.

The cost of collecting the eggs is very low, and is paid by the circuit, while the remaining expenses are borne by the society and deducted from the payments to the circuits. The collector receives

generally 1.6 cents per 2.20 pounds (6 öre per kilogram) which, on an average of 16 eggs to the kilogram, amounts to 1.2 cents per dozen. The cost of transporting the eggs from the stations of the circuits to the steamer is on the average 2 öre per kilogram (0.53 cent per 2.20 pounds) or, at the same average of eggs per kilogram, 0.4 cent per dozen. The total expense, then, for the eggs from the time they are taken from the nests till they are placed on the steamer for foreign countries is a trifle over 1½ cents per dozen.

The directors of the circuits pay for the collecting and the packing. The cases are 0.50 m. wide and 0.75 m. long, with two compartments, and hold about 500 eggs. A case costs \$2 and lasts about 100 journeys. The packers place a layer of wood wool on the bottom of each compartment, and on this a cardboard case containing 50 eggs, each egg in a separate cell. Over this they lay another pad and another cardboard case, and so on, until there are five tiers of eggs. On top they place a heavier pad immediately under the lid.

The collector has charge of the stations and superintends the packing of the eggs. It is important for the successful management of the business that he be a man who is trusted and well known in the community. Another one of his duties is to make periodical inspections of the nests of the poultry yards.

The society has nine stations where the eggs are packed for foreign export. Copenhagen, which is also the headquarters of the society, and Ringsted are on the island of Zealand, Svendborg and Odense on Fyn, Rudkjøbing on Langeland, and Aalborg, Aarhus, Vejle, and Esbjerg in Jutland. Five of these—Copenhagen, Aalborg, Aarhus, Vejle, and Esbjerg—are also ports of shipment. Esbjerg, situated on the west coast of Jutland, and favorably located for the British trade, is, as might be expected, the principal port of shipment. In 1902 one-third of all the eggs exported passed through this port. All the exports from Esbjerg go to Great Britain.

On their arrival the cases are weighed before and after they are emptied. Women generally do the grading, testing, and packing. In grading they work behind long tables on which are six trays, or wooden frames, one tray for each size or grade. The frame, or tray, holds 60 or 120 eggs, and has a hole for each egg. Practice makes the sorters very expert. As a rule, they see at a glance to what grade an egg belongs, and by long practice they become so skillful that they can grade 120 eggs without being an ounce out of the way. As the trays are filled a man removes and weighs them. When a tray weighs too much or too little for its grade, large eggs are replaced by small ones, or vice versa, till the correct weight is obtained. Thereupon they are taken into a dark room to be tested.

The testing apparatus is a box, 8 by 30 inches at the bottom, 2 feet high, and widening upward. It is lined with mirrors, and has four

16-candle electric lights at equal distances along the bottom. The tray with the eggs, thick ends down, fits on top. While the bad eggs appear dark and cloudy, the light shines through the sound ones, giving them a clear pink color. The dark or suspicious eggs the tester breaks, but if they are found upon breaking to be sound, the person who supplied them is paid in full; otherwise he is fined according to the rules of the society. The packing stations are so well equipped for determining the freshness of the eggs and the system works so well that even attempts at fraud are rare.

Now it remains to stamp them with the trade-mark of the society and to pack them for export. The boxes used for this purpose are about 20 by 79 inches and 9 inches deep, made of light pine wood, and hold 1,440 eggs. They are nonreturnable. First the packers spread on the bottom a layer of long, clean rye straw. On this they pack a layer of eggs snugly together without anything between them. Over these is placed another layer of rye straw, then another layer of eggs, and so on until there are four layers of eggs, and then one substantial layer of straw on top. Then the lid is nailed down, and the trade-mark of the society, the grade, weight, and number of the eggs contained are affixed. The method of packing does not appear to be altogether uniform. Many stations use wood wool instead of straw.

After a consignment has been thoroughly examined, the officers of the society remit to the circuit a numbered receipt stating the current price per pound, the number and the weight of the eggs, as well as the number of spoiled or suspicious eggs.

Most of the Danish eggs go to England, and, as a rule, the eggs reach London in forty to fifty hours. The large English firms have agents in Denmark who generally buy the eggs free on board the ship. English dealers deduct 60 eggs per case for breakage.

The table below gives the price per great hundred (120 eggs) in London at four seasons of the year—the 22d of March, June, September, and December—or, where no quotation is given for this, the date the nearest before or after.

Prices of first-class Danish circuit eggs on the London market, 1900 to 1903.

[Per great hundred=120 eggs.]

Year.	Extra large.		Large.		Small.	
1900.						
March 19	\$1.82 to	\$1.95	\$1.70 to	\$1.76	\$1.18 to	\$1.24
June 19	1.95	2.07	1.76	1.82	1.40	1.12
September 24	2.19	2.43	2.19	2.25	2.01	2.06
December 24	3.62	3.74	3.41	3.53	2.98	3.16
1901.						
March 23	1.70	1.82	1.18	1.70	.....	
June 24	2.01	2.07	1.82	1.88	1.18	1.24
September 23	2.19	2.31	2.07	2.13	1.82	1.95
December 23	3.41	3.53	3.22	3.28	2.80	2.96

Prices of first-class Danish circuit eggs on the London market, 1900 to 1903—Continued.

Year.	Extra large.		Large.		Small.	
1902.						
March 24	\$1.70 to	\$1.82	\$1.58 to	\$1.64	.....	
June 23	1.88	1.95	1.70	1.82	\$1.12 to \$1.24	
September 22	2.19	2.43	2.19	2.25	1.95	2.07
December 22	2.47	3.62	3.28	3.41	2.80	2.92
1903.						
March 20	1.70	1.76	1.18	1.24	.....	
June 22	2.01	2.07	1.82	1.95	1.24	1.70
September						
December 21	3.40	3.52	3.16	3.28	2.79	3.03

COMPARATIVE MARKET PRICES OF EGGS IN LONDON.

[Per great hundred = 120 eggs.]

On March 19, 1903.

French	\$1.58 to \$2.31	
Italian	1.52	1.82
Hungarian	1.34	1.45

On June 22, 1903.

French, extra	\$2.43 to \$2.55	
French, choice	2.25	2.31
French, ordinary	2.06	2.19
Danish, 18 pounds	2.06	
17 pounds	1.94	
16 pounds	1.76	
15 pounds	1.64	
14 pounds	1.51	
Italian, extra	1.94	2.06
Italian, choice	1.64	1.70
Italian, ordinary	1.45	1.57
Hungarian	1.15	1.51
Russian	1.03	1.45

On September 19, 1903.

French	\$2.00 to \$2.91	
Italian	1.94	2.43
Hungarian	1.34	1.94
Russian	1.39	1.82

On December 19, 1903.

French	\$3.03 to \$3.65	
Italian	2.67	3.22
Hungarian	1.76	2.43
Russian	1.70	2.36

OTHER EGG SOCIETIES.

There are two small societies exporting eggs—one at Nysted, with a membership of 700, and another at Gaverslund, with a membership of 300. Besides these, five bacon factories have egg-packing centers and

a total annual export of 6,000,000 pounds of eggs, valued at \$670,000, among which are: At Kalundborg, 750,000 pounds; Slagelse, 700,000 pounds; Esbjerg, 2,200,000 pounds. The Danish Cooperative Butter Factory also deals in eggs.

GREAT BRITAIN.

NUMBERS OF POULTRY.

The "Agricultural Returns" have not included statistics on poultry since 1885, and in consequence of this omission much definite information on this subject is now lacking. Persons, however, familiar with this industry have made estimates which may be more or less correct, but which can not take the place of official figures. The following are the last available figures for Great Britain:

Numbers of poultry in Great Britain, 1884 and 1885.

Kinds of fowls. ^a	1884.	1885.
Turkeys.....	500, 770	474, 583
Geese.....	888, 313	885, 310
Ducks.....	2, 368, 390	2, 201, 601
Chickens.....	12, 303, 539	12, 401, 533
Total.....	16, 061, 012	15, 963, 027

^a The numbers are exclusive of those kept in towns and by cottagers with less than a quarter of an acre of land.

The numbers of the different kinds of poultry for England alone in 1885 is shown below:

Turkeys.....	356, 485
Geese.....	615, 724
Ducks.....	1, 736, 788
Chickens.....	9, 556, 053

WHY EGG PRODUCTION HAS DECREASED.

The decline of British agriculture in the last century no doubt arrested the development of the poultry industry also. We may to some extent attribute the backward condition of this industry in Great Britain to the lack of a numerous class of small farmers devoted to intensive cultivation. The small holdings in England are comparatively few. Most of the agricultural land is in farms of from 100 to over 1,000 acres and this reduces the number of poultry runs. With the high price of land and grain the English could hardly expect to vie with foreign countries in the production of ordinary eggs. But their nearness to the great markets gives them an advantage in the sale of new-laid eggs—the line that is most profitable and in which the French alone could seriously compete. For this reason the improvement in the British poultry industry directly affects the French trade,

as appears from the fact that the French trade has declined as the English has developed. With a perfect system of collecting, packing, and shipping eggs—such, for example, as the Danes follow—the trade in new-laid eggs should be profitable. Better rates also could be obtained from the railway companies. Now the English complain that foreigners enjoy cheaper rates than localities through which this trade passes can obtain.

IMPORTATION OF EGGS.

The most striking feature in connection with this industry in England is the enormous importation from abroad. Already in the "fifties," when the annual imports did not yet exceed one million great hundreds, writers on this subject became alarmed and attempted to call the attention of the English to the growing importance of the egg trade. They expressed the hope that the reviving industry at home would soon supplant the foreign imports. After fifty years have passed, however, the imports have increased twentyfold and the revival has only begun.

It is a long time since England ceased to supply her own demand in poultry and eggs. As imported eggs could be bought more cheaply than they could be produced, the industry did not receive the attention it deserved. With the decline of agriculture in England and the growth of large cities and manufacturing centers, the imports have steadily increased. The table below shows the increase in number and value since 1871. The latter has increased fivefold and the former nearly sixfold in these years. With the growth of imports the average price per dozen has fallen from 18.4 cents to 16.2 cents.

Imports of eggs into the United Kingdom, 1871 to 1902.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	<i>Dozens.</i>	<i>Dollars.</i>		<i>Dozens.</i>	<i>Dollars.</i>
1871.....	33,372,750	6,149,368	1888.....	93,899,390	15,004,332
1872.....	44,299,310	8,576,693	1889.....	94,325,030	15,220,426
1873.....	55,039,500	11,480,181	1890.....	102,912,460	16,686,284
1874.....	56,712,269	11,840,847	1891.....	106,283,140	17,059,622
1875.....	61,768,630	12,457,559	1892.....	111,394,190	18,466,995
1876.....	62,752,170	12,752,157	1893.....	110,459,860	18,860,836
1877.....	62,598,800	12,036,689	1894.....	118,769,680	18,426,170
1878.....	65,309,560	12,220,249	1895.....	127,225,860	19,482,770
1879.....	63,892,320	11,172,121	1896.....	132,450,011	20,364,628
1880.....	62,284,050	10,878,822	1897.....	140,317,540	21,202,401
1881.....	63,059,930	11,301,911	1898.....	144,246,010	21,690,560
1882.....	67,660,200	11,607,872	1899.....	161,747,560	24,548,582
1883.....	78,369,680	13,295,546	1900.....	168,820,780	26,308,406
1884.....	82,800,073	14,163,914	1901.....	170,717,767	26,745,150
1885.....	83,565,680	14,264,865	1902.....	189,667,950	30,702,575
1886.....	86,264,280	14,055,293	1903.....	198,488,940	32,204,545
1887.....	90,840,770	15,016,467			

POULTRY SOCIETIES.

In recent years the English have begun to organize poultry societies according to the Danish system. The National Poultry Organization Society came into existence in 1898 for the purpose of encouraging the poultry industry in the country and of establishing a system more in accordance with the requirements of modern conditions. The society has issued a series of leaflets to disseminate information about poultry and to give advice regarding the choice of breeds, the formation of branches and collecting depots, the methods of rearing, and marketing the produce. In May, 1903, there were in England eight branches and twenty-four collecting depots, with a membership of 2,217. At that time there was but one branch in Scotland and none in Wales.

PER CAPITA CONSUMPTION.

The Agricultural Statistics of the Board of Agriculture for 1902 prints a table giving the per capita consumption of imported eggs in the United Kingdom from 1882 to 1902, which is reproduced here. According to this the per capita consumption has more than doubled in the last twenty years. As Ireland is not an importer of foreign eggs, it should not be included in this table, and this would raise the per capita consumption for the rest of the Kingdom.

Per capita consumption of imported eggs in the United Kingdom, 1882 to 1902.

Year.	Number.	Year.	Number.	Year.	Number.
1882.....	23	1889.....	30	1896.....	40
1883.....	27	1890.....	33	1897.....	42
1884.....	28	1891.....	34	1898.....	43
1885.....	28	1892.....	35	1899.....	48
1886.....	29	1893.....	34	1900.....	49
1887.....	30	1894.....	37	1901.....	49
1888.....	31	1895.....	39	1902.....	54

IMPORTS OF POULTRY.

A glance at the census of 1885 shows that the stock of poultry in Great Britain can not feed the large population of the Kingdom; nor does the small surplus from Ireland suffice for this purpose. The imports into Great Britain have increased year by year—from \$1,712,463 in 1886 to \$5,850,934 in 1903. The largest imports before 1899 came, in order of importance, from France, Belgium, Russia, and Holland, and since that time from France, Belgium, Russia, and the United States. The imports from France have been large and steady, valued at \$989,870 in 1886 and \$1,241,699 in 1903. Except for the last year these are the largest from any single country. The exports from Belgium are in part reexports from Italy and elsewhere. Russian exports to Great Britain have gradually grown from \$88,891 in 1896 to \$1,577,169 in 1903, when they surpassed those of any other country.

In the last four years the imports of poultry from the United States have figured largely, rising from \$756,741 in 1900 to \$1,139,087 last year.

Values of poultry and game imported into the United Kingdom, 1886 to 1903.

1886.....	\$1,712,463
1887.....	1,995,722
1888.....	1,963,812
1889.....	2,302,794
1890.....	2,422,821
1891.....	2,223,888
1892.....	2,839,262
1893.....	2,817,504
1894.....	2,340,222
1895.....	2,945,011
1896.....	3,433,209
1897.....	3,556,073
1898.....	3,102,355
1899.....	3,821,633
1900.....	4,915,961
1901.....	4,772,854
1902.....	5,153,837
1903.....	5,850,934

IRELAND.

WORK OF THE CONGESTED DISTRICTS BOARD.

Ireland is a grain-producing country and seems always to have had a considerable number of poultry. From the annual census taken by the Royal Irish Constabulary and Metropolitan Police, it appears that the number of poultry has grown from 11,159,002 in 1870 to 15,276,128 in 1891 and to 18,153,714 in 1903. But an important change, which does not appear from these figures, is that the quality has been improved; that well-nigh the entire stock of poultry, which was not very productive, has been replaced by better breeds. This silent transformation has been brought about mainly by two organizations. Of course, in Ireland as in other countries, the individual poultry breeders have often done good work and thus contributed to the general progress, but an enumeration of these would lead us into greater detail than is the purpose of this article.

Passing by these individual poultry breeders, the organization that first entered the field was the "Congested Districts Board" appointed in 1891 to continue for twenty years and thereafter until Parliament shall otherwise determine. The board was to consist of ten members and its object was to improve the congested districts, which were defined as follows:

Where at the commencement of this act more than 20 per cent of the population of a county live in electoral divisions whose total ratable value divided by the number of the population gives a sum of less than £1 10s. for each individual, those divisions shall form a separate county known as "congested districts county."

Numbers of poultry in Ireland for a series of years.

Year.	Chickens.	Turkeys.	Geese.	Ducks.	Total. ^a
1871.....					11, 717, 182
1872.....					11, 737, 529
1873.....					11, 863, 155
1874.....					12, 068, 375
1875.....					12, 139, 138
1876.....					13, 618, 500
1877.....					13, 566, 083
1878.....					13, 711, 174
1879.....					13, 782, 835
1880.....					13, 430, 182
1881.....					13, 972, 426
1882 ^b					13, 998, 651
1889.....					14, 856, 517
1890.....					15, 408, 428
1891.....	9, 289, 925	932, 569	2, 117, 295	2, 876, 754	15, 276, 128
1892.....	9, 422, 946	950, 674	2, 115, 828	2, 846, 133	15, 335, 749
1893.....	9, 978, 278	1, 031, 928	2, 177, 227	2, 909, 252	16, 097, 461
1894.....	10, 248, 280	1, 011, 591	2, 082, 005	2, 838, 071	16, 180, 601
1895.....	10, 515, 291	1, 001, 818	2, 026, 343	2, 827, 044	16, 369, 525
1896.....	11, 339, 813	1, 090, 539	2, 142, 186	2, 973, 233	17, 537, 570
1897.....	11, 654, 561	1, 070, 705	2, 022, 725	2, 948, 969	17, 777, 248
1898.....	11, 641, 561	1, 070, 705	2, 022, 725	2, 948, 969	17, 683, 960
1899.....	12, 086, 544	1, 120, 464	2, 011, 286	3, 014, 607	18, 233, 520
1900.....	12, 403, 743	1, 108, 632	2, 007, 673	3, 027, 040	18, 547, 307
1901.....	12, 679, 913	1, 124, 795	1, 962, 161	3, 040, 897	18, 810, 717
1902.....	12, 681, 227	1, 038, 472	1, 836, 195	2, 947, 813	18, 504, 324
1903.....	12, 529, 473	959, 787	1, 768, 613	2, 895, 841	18, 153, 714

^a The totals in this table do not always agree exactly with the sum of the other columns, as they are later and revised figures.

^b Does not include the poultry of counties Clare and Limerick.

In the first report of the board submitted in 1892 eighty-four congested districts are given, covering an area of 3,608,569 acres and including a population of 549,516. Roughly speaking, these districts are situated in the northwestern, western, and southwestern parts of the island, including the counties of Donegal, Leitrim, Sligo, Roscommon, Mayo, Galway, Clare, Kerry, and Cork. Parliament placed the income from certain sums of money at the disposal of the board and empowered it to take such steps as it thought proper for improving the congested districts in connection with agriculture, forestry, live stock, poultry, etc. As practically all the inhabitants of congested districts in Ireland are in possession of small plots of ground, the development of agriculture and the improvement of live stock and poultry are of primary importance. We shall deal only with the last subject—an industry, perhaps, which more than any other affected the poorest class of “occupiers.” The intention of the board is not so much to provide relief work as permanently and materially to develop the trade and industries of the localities where it operates; and it was recognized that in point of importance the poultry industry comes next

only to the dairying industry, and that as an industry for small farmers or cottagers it is second to no other.

EFFORTS TO IMPROVE THE BREEDS OF POULTRY.

The board soon found that the poultry was of inferior breeds and they set about an improvement. As the income at the disposal of the board, if divided among the families in question, would have amounted to only a few shillings each, it seemed that some plan should be devised which would afford instruction and opportunities rather than money for those who were willing to struggle to improve their condition. Working under new conditions, it was not an easy matter to hit upon the best plan at the start.

Early in 1892 the board began to distribute purebred cockerels to the cottagers in exchange for their male birds. During the first year 581 cockerels of the Langshan, Black Minorca, White Leghorn, and Plymouth Rock breeds were bought and distributed. The attempt was made, so far as practicable, to confine one breed to each district. The Black Minorcas and Plymouth Rocks showed the best results, so these breeds only were sent out the following year.

The board tried to show the country folk the benefit of keeping good breeds of laying and table poultry, but unfortunately, as in the case of cattle and horses, the practice of the people too generally was to send all the good birds to market, keeping none for breeding purposes. They did not at first see the value of the new and imported breeds, for, neglected and left to themselves, these breeds often failed to thrive or even to do as well as the old Irish hen. Disease broke out among them and many died when they came into the hands of people who did not know how to take care of the more highly cultivated breeds.

In 1893 the board employed an expert to select and buy the breeds suited to the different localities, so that the 1,200 cockerels and pullets distributed this year fared somewhat better. In places where disease ravaged severely, the Indian Runner duck, as being better suited to the localities than chickens, was introduced in great numbers; they proved more prolific layers than the chickens and continued free from the disease.

As the plan of distributing birds proved rather expensive and not altogether successful, the board in 1893 adopted the plan of exchanging the eggs of purebred chickens for those of the common kinds, paying the distributor 1d. for each egg he exchanged. As centers of distribution, one or two farmers in a district obtained from the board from 20 to 30 pullets and a suitable number of cocks on condition that they exchange the eggs of the purebred fowls for an equal number of the common kind during the months of February, March, April, and May. As compensation, they received from the board 1d. for each

egg so given out. In 1901 the board reduced the compensation to a half-penny per egg; and in case of poultry farms to be established in the future it allowed the farmers to exchange the eggs of purebred chickens at their full value in common eggs or to sell them at a rate not to exceed a maximum price fixed by the board. If they complied with the conditions of the management they received in addition each year a cash bonus.

These farms gradually increased in number—from 7 in 1892 to 30 in 1895, 65 in 1898, and 107 in 1901—and the number of eggs exchanged rose from some 50,000 during the sitting season, about 1897, to 130,535 in 1901.

Some of the farms, however, engaged partly or altogether in raising ducks to supply damp and exposed places where the imported breeds of chickens were not hardy enough. Thus, in 1891, 53 farms distributed eggs of fowls and ducks, 17 distributed eggs of fowls only, and 37 of ducks only. From June, 1896, down to the present time the board has employed an expert to visit the farms at regular intervals and superintend all the operations connected with this industry. It is worthy of note that this expert was a lady. The sisters, also, in several convents became interested and eagerly took up the work of teaching the peasantry better methods of poultry raising.

ESTABLISHMENT OF PLANT FOR FATTENING POULTRY.

In 1897 the board established at Carrigart, County Donegal, a plant for fattening poultry. It was not successful at first and soon closed on account of unsatisfactory management, but afterwards under expert guidance it proved useful and even showed a handsome annual profit. Although its principal business was to buy poultry from the neighboring farmers and cottagers, and to fatten and export it to Scotland and England, it also distributed eggs in the neighborhood. Thus in 1899 and 1900 the plant marketed 8,274 fowls, 218 ducks, 186 geese, 192 turkeys, and distributed 3,000 eggs of purebred poultry.

Although much of this work lacked the thoroughness and system it afterwards acquired under the cooperative societies, it contributed its share to the final success of the poultry industry in Ireland.

COOPERATION ESTABLISHED.

The second impetus to the poultry development in Ireland came from the cooperative movement. This may be said to have had its beginning at the Congress at Glasgow, when the Cooperative Union of Great Britain decided to spend a sum of money to promote cooperation in Ireland. This union sent an agent to Munster to organize cooperative dairy societies in order that they might serve as a practical illustration of the benefits of cooperation. The experiment was so successful that as early as 1893 there were thirty cooperative dairy societies.

THE IRISH AGRICULTURAL ORGANIZATION SOCIETY.

In the following year the Irish Agricultural Organization Society was formed with the general object of promoting agricultural organizations for any purpose that might seem beneficial, and to counsel and advise those engaged in agricultural pursuits. Men of all creeds and parties joined and undertook to supply funds for a five years' experiment. The society rapidly grew in public favor and has been the means of bringing many advantages within the reach of the poorer members of the rural community. Its popularity was such that when the first term expired it was voted to continue the work for another five years, and it sends out special experts to organize the several kinds of societies—dairy, agricultural, rural banks, home industries, poultry, bee keepers, etc.

Besides carrying on the work of practical organization, the society prints and sends out numerous leaflets, and publishes a weekly paper and an annual report.

The funds necessary for doing this work for Ireland's rural industries have come from the annual fees and direct contributions of the affiliated societies and from subscriptions and donations of wealthy friends of the movement on both sides of the Atlantic. The sum of about \$150,000 that has been expended by the society in the last seven years is estimated to have resulted in an added gain of about \$5,000,000 to the industry of the associated farmers,^a besides developing the energies and business capacity of the people. Not the least of the benefits arising from cooperation was the improvement of the Irish themselves; they learned to work together and exchange ideas among themselves; they discussed and familiarized themselves with business and agricultural methods, and in this way became better farmers, better business men, and better citizens. While the politicians declaimed against landlordism and saw the salvation of the country in political measures only, the friends of cooperation showed that the abolition of rents could not make their farms more productive nor raise the price of their produce. Foreign competition has rendered the position of Ireland precarious even in the home markets. Modern principles had revolutionized the methods of production elsewhere, but the Irish remained stationary and clung to antiquated ways. The only thing to do was to adopt up-to-date methods and try to regain their lost advantages. Their attention was called to the remarkably prosperous condition of Denmark, where cooperation had had full scope. Their proximity to the great markets should inspire the Irish with hope of even greater success than the Danes enjoyed.

^a Annual report, Irish Agricultural Organization Society, 1902, Appendix III.

ESTABLISHMENT AND GROWTH OF POULTRY SOCIETIES.

Soon other forms of cooperation were taken up, and in 1898 the first cooperative poultry societies were organized, and several agricultural societies went into the same line of work. In the beginning they wisely decided to confine their operations to the sale of eggs and not to take up for the time the more difficult work of fattening and preparing poultry for the market. In the course of time they found that a society could work to greater advantage on an extended scale, and so the societies that were started in 1902 have, as a rule, a wider area, a larger capital, a larger membership, and a larger business than most of the societies formed prior to that time.

The fifty-six cooperative societies for the raising of poultry and the sale of eggs are situated in the following nineteen counties:

County.	Number of societies.	County.	Number of societies.
Donegal	4	Kings	1
Londonderry	3	Wicklow	2
Antrim	3	Waterford	1
Tyrone	4	Cork	5
Fermanagh	3	Kerry	1
Sligo	11	Limerick	1
Mayo	2	Kilkenny	1
Galway	4	Clare	1
Cavan	2	Total	56
Westmeath	4		
Monaghan	3		

These societies are formed for the purpose of improving the breeds of chickens and to enable the farmers to get a remunerative price for their products by finding openings for the sale of eggs and poultry. The shares are 5s. each, and the farmer must take one share for every 25 chickens in his possession.

The growth of these societies in number and volume of business appears from the following table:

Year.	Number of societies.	Value of business.	Year.	Number of societies.	Value of business.
1898	3		1901	29	\$31,120
1899	16	\$38,698	1902	31	145,576
1900	21	46,110	1903	56	

The volume of business grew regularly from \$38,698 in 1899 to \$145,576 in 1902. Thus it appears that the business of the societies in 1902 was twice as large as that of 1901, more than three times as large as that of 1900, and nearly four times as large as that of 1899. This business refers only to societies registered as "poultry societies"

and leaves out of account the trade in eggs and poultry done by agricultural or dairy societies. The business of one of these societies alone—that of Windgap—amounted in 1902 to \$6,326.

It is encouraging to note that the membership as well as the business of the poultry societies has grown from year to year. In 1902 the 31 societies had a membership of 5,906.

ORGANIZATION AND METHODS OF PROCEDURE.

The Irish Agricultural Organization Society has adopted the following mode of procedure in establishing local poultry societies: First of all the organizers distribute leaflets showing the advantages of cooperation and urging the farmers to form organizations. These leaflets are sometimes in the form of questions and answers, and often lighted up with quaint flashes of Irish humor.

LOCATION OF CENTRAL STATION.

When a society has been formed the Irish Agricultural Organization Society sends an expert to give advice as to where to locate the central station. It is essential that this be within easy access of a railway and at the same time central and convenient to the district embraced by the society. If possible it should either be a seaport town or a station on a main line of railway, from which through rate can be had to markets in Great Britain.

SUITABLE BUILDINGS.

If old buildings are not available a two-story building is erected, with an earth floor, about 40 by 20 feet. The material is sometimes stone or brick, but more often galvanized iron sheets lined with thin, matched boarding. The upper story is divided into two rooms—a small one, 20 by 10 feet, to be used for a committee room, and a large storeroom for wood, straw, wood wool, and other packing materials. On the lower floor a small space is reserved for the office, and in the remainder the eggs are tested, crated, and packed, and the poultry killed, plucked, dressed, and packed.

In addition to the main building, there are usually smaller sheds for housing the horses and sheltering the poultry that are fattened. The society must necessarily have one or more horses, with complete sets of harness and light vans for collecting the eggs and poultry and conveying them to the railway station or steamboat; an oil cover for each van; several sets of scales and weights; testing and grading machines; a set of plain carpenter's tools; a set of stencils and branding instruments; and a set of account books.

BRANCH DEPOTS FOR COLLECTING EGGS.

In connection with the central station there should be established a certain number of branches, or collecting depots. Five or six will

probably be sufficient to begin with. They ought to be within carting distance of the central station, as local rates on railways for short distances are high. All that is needed at local depots is a set of scales and weights. Here the eggs are placed in large boxes with pasteboard compartments and forwarded to the central station.

METHODS OF COLLECTING.

A man who is thoroughly familiar with the neighborhood is employed to take charge of a horse and van. He works seventy hours a week and collects twice a week on each round. He blows a horn at frequent and regular intervals to give warning of his approach, in order that the eggs may be in readiness when he arrives. When the lanes and byways are badly kept and it is difficult to drive to the cottages, children usually bring the eggs to the main road. The collector weighs the eggs and pays for them at the current price for the day, and hands the producer a duplicate statement of the transaction as a check to his claim on the dividends at the end of the year. The collector must be careful not to accept dirty eggs or he will have to bear the loss in deductions made from his wages.

As the collectors carry no testing apparatus with them, they can judge of the age of the eggs only by the appearance of the shells, but by experience they soon become so expert in this that a stale or bad egg seldom escapes their notice. Each egg, however, has the number of the producer stamped on the end, so that a bad egg can always be traced to the one who sells it. In the evening the collector surrenders at the station with his load of eggs the register of his purchases and the balance of his cash for the day, and takes home with him a new supply of boxes, straw, and cash, and a new register, so as to be able to make an early start the next day. At the station the eggs are weighed again at the earliest opportunity in order to ascertain whether the weight agrees with the sum paid out, and the register of each individual sale is credited to the members on the books of the society.

THE SORTING OF EGGS.

The eggs are, in the first place, graded, or sorted, into three classes, according as they weigh $13\frac{1}{2}$, 15, or 17 pounds per great hundred (10 dozens). As the breeds improve the eggs become larger. The new system of buying eggs by weight instead of by the dozen has brought about this rational change. At Mallow, where there is a large cooperative poultry society, 50 per cent of the eggs in 1899 weighed $13\frac{1}{2}$ pounds, 30 per cent weighed 15 pounds, and 20 per cent weighed 17 pounds per great hundred. Four years later 30 per cent weighed 14 pounds, 30 per cent weighed 16 pounds, and 20 per cent weighed 17 pounds. It is obvious that a dozen eggs of large size, if sold by weight, bring more money and entitle the producer to a larger

share in the annual dividends than the same number of small ones. So long as small eggs brought the same price as large ones there was no inducement to market large ones, but as soon as the trade put a premium on large-sized eggs it became profitable to have better breeds of fowls for egg production. The demand for large eggs is now so great that a great hundred of 17 pounds will sometimes command fancy prices, and often run, especially in the winter, as high as \$1 above eggs weighing 14 pounds per great hundred.

The eggs are graded and placed with the thick end up on perforated trays ready for the testing machine. This testing apparatus consists merely of a tin-lined box, at the bottom of which is a light. As the trays are placed on top the light shines through the fresh eggs, while the old and stale ones appear dark and cloudy. At this time the stamp of the society is placed on each egg.

METHODS OF PACKING AND SHIPPING.

The British trade requires that the eggs shall be shipped in non-returnable cases, each case holding three, six, or twelve long hundreds.^a Still, packers are advised not to put over six hundred in a box and to have a partition in the middle, for cases that are too heavy often break during shipment. The cheapest and lightest kinds of woods, therefore, are used for cases, such as deal, poplar, or lime. The boards are sawed at local mills to the exact dimensions required for boxes and stored at the stations. The cases are nailed together as they are needed. For packing, either straw or wood wool is used. The best straw is that of oats, but barley straw is sometimes used. The wood wool is made from one of the soft, resinous kinds of deal or fir. Before using, the rosin is removed and the packing material is made clean and dry so as not to injure or impart any odor to the eggs. The eggs are packed in layers, with straw or wood wool between. Each case contains but one grade of eggs.

On the lids are placed the following marks: "Irish eggs," "With care," "This side up," "Keep dry," and on the ends are branded the number of long hundreds and the net weight above the words "New-laid Irish eggs." The case is now ready to be turned over to the railway or steamship company for shipment to Great Britain.

TRANSFORMATION DUE TO POULTRY SOCIETIES.

CONDITIONS BEFORE ORGANIZATION OF POULTRY SOCIETIES.

Before the advent of the poultry societies the poultry industry in Ireland was in no better condition than in many other countries where the chickens are left to shift for themselves. The farmers were satisfied to sell small eggs and scrawny spring chickens to the local dealers

^a A long hundred is used in Ireland for great hundred=120 eggs.

at low prices. As little or no attention was given to the matter of having good breeds, and the chickens were often kept until they were ten years old, they did not lay over one hundred eggs a year. Not hatched at the right season nor properly cared for, they did not lay in winter when the price was high. When the price was rising the housewife held the eggs as long as she dared for the sake of the extra gain and then sold them to what are called "higglers," or, in Ireland, "egglers." The dealers held them still longer and sent them dirty and unselected to the British market in musty straw and in cases that had crossed the Channel more than once before with various contents. No wonder many an Irishman was puzzled to know what became of those eggs when they had reached this well-seasoned state. The situation became such that the Irish eggs, compared with eggs from the Continent, appeared in an unfavorable light and brought the lowest price on the British market.

CHANGE IN METHODS OF PACKING DEMANDED.

In 1898 matters came to a crisis, when the merchants of Liverpool and Glasgow, who had before handled Irish eggs, gave notice by circular that after a certain date they would buy only fresh eggs packed in dry, clean straw or wood wool and in nonreturnable cases, such as were used in the continental trade. The exporters, who could only gain by the change, sided with the merchants, but the farmers' wives continued as before to keep their eggs until they had a goodly number on hand. This bad habit came near ruining an industry which otherwise proved profitable to the country. The merchants refused to yield, as they could get what they needed from a half dozen countries, and had given the Irish this opportunity in order that they might compete with the foreign imports.

PRESENT CONDITION OF THE POULTRY INDUSTRY.

What the poultry business or the egg trade of Ireland has been during the last years can only be estimated, as there are as yet no available statistics on the subject. From the figures already given we see that the egg trade of Ireland does not rank with that of Denmark, but that a great improvement has been accomplished is evident, and the interest shown in the work as well as the nearness of the country to the great markets justifies the belief that it is destined to grow.

INSTRUCTION IN POULTRY KEEPING.

In the winter of 1902 courses of instruction in the practical management of poultry societies were given at Dunboe, County Kerry, and at Dervock, County Antrim. These were preliminary courses, and intended to satisfy the urgent demand for managers of newly formed poultry societies. The following year the department of agriculture

and technical instruction for Ireland gave a special course of instruction in poultry keeping at the Albert Agricultural College, Glasnevin, County Dublin. This course was designed for young men and women wishing to obtain a practical training in poultry keeping or to qualify themselves as itinerant instructors in poultry keeping. In order to facilitate this instruction, poultry runs, on which are represented the pure breeds of fowl, have been provided. Furthermore, the department has announced that for the year 1903-04 it is prepared to approve of the appointment of at least one instructor for each county of Ireland, provided a suitable one can be obtained. It outlines at the same time the general plan, limits the pay, and prescribes the duties of the instructors. This scheme of the department is published herewith in full:

SCHEME FOR ENCOURAGING IMPROVEMENT IN THE POULTRY-KEEPING INDUSTRY, 1903-04.

1. The department is prepared, provided a suitable instructor in poultry keeping can be obtained, to approve of the appointment of at least one such person for each county in Ireland.

2. The department will, as far as possible, assist county committees in obtaining an instructor by supplying the names of persons qualified for the post.

3. Unless in exceptional circumstances the remuneration of the instructor shall not exceed £2 [\$9.73] per week, in addition to expenses of locomotion, which include second-class railway fare, car hire when necessary, or a bicycle allowance of 2d. [4 cents] per mile in lieu thereof.

4. The appointment of the instructor shall be determinable at any time by four weeks' notice in writing on either side.

5. It will be the duty of the instructor to deliver courses of lectures on poultry keeping, including the selection of breeds, the hatching and rearing of chickens, the feeding and housing of poultry, and the marketing of the produce; to visit poultry runs and give such advice as may be desired by poultry keepers; to inspect the egg-distribution stations referred to in clause 12; to report to the department and to the county committee regarding the progress of his or her work as may be required, and generally to give his or her whole time towards promoting improvement in poultry keeping in the county.

6. For this purpose the county should be divided into circuits, each comprising not less than five centers. The instructor should work for at least four weeks in each circuit, and deliver one lecture per week at each center during that time. The instructor will, when invited to do so, visit, either on the day of the lecture or on the following day, any of the poultry runs in the neighborhood, and give such information on poultry keeping as the circumstances of the case may suggest.

The county committee alone are responsible for the selection of the centers and the arrangement of lectures. No work of this nature should be undertaken by the instructor, though it is desirable that he or she should be consulted.

7. It will be the duty of the county committee to select centers at which the lectures will be given and to appoint a local committee, with an honorary secretary, at each center, who should select the school and arrange for the hiring, lighting, and warming of the room in which the lectures will be delivered.

It will also be the duty of the county committee to undertake the responsibility of seeing that the instructor's time is fully and usefully employed.

The county committee shall keep a separate account of all expenditure under this scheme, and shall furnish detailed statements of such expenditure as shall from time to time be required by the department.

8. Lectures should be arranged, whenever possible, to be given in schoolrooms, in the evenings, and should be held in rural centers only. Towns and larger villages should be avoided, as experience has shown that the greatest success attends those lectures which are given in the rural parts of the county, especially when the lectures are delivered in districts where the greatest number of those interested in poultry keeping is to be found. The local committee at each center should be responsible for appointing a representative chairman for each lecture, as well as for the distribution of the short syllabus, which will be prepared by the lecturer as soon as appointed. The local committee should undertake to have posters, which will be supplied by the secretary of the county committee, effectively displayed throughout the circuit. Each lecture should be followed by a discussion, during which farmers and others interested in poultry keeping will be invited to ask questions relative to their business.

9. The lectures should commence early in autumn and be continued until the end of the hatching season. If employed during the summer months, the instructor should, during that season, visit poultry runs and inspect egg-distribution stations.

DISTRIBUTION OF SITTINGS OF EGGS OF PURE BREEDS.

Hens and ducks.

10. In counties where instruction in poultry keeping has been provided the department are prepared to sanction a limited number of premiums of £5 [\$24.33] each, being awarded to selected applicants who distribute at least sixty sittings of eggs; those who distribute less will be paid in proportion to the number distributed. When the demand for sittings is not pressing the owner may set eggs for his own use, but such sittings will not count towards a premium. Applicants must agree to comply with the following conditions:

(1) To keep one pure breed of hens only. In exceptional cases the department may approve of more than one pure breed being kept, provided they are satisfied that the selected person, houses, runs, birds, etc., are suitable.

(2) To sell or destroy any existing fowl on the farm of which the instructor or the department may disapprove, and not to bring on the farm fowl of any description without the approval of the instructor or of the department.

(3) To keep no male birds on the farm other than those used for stock purposes of the breed or breeds of fowl approved of.

(4) When a premium is claimed for hens alone, to keep not less than 30 or more than 60 of the selected breed. If the premium is claimed in respect of hens and ducks, to keep not less than 20 or more than 60 hens or pullets of the selected breed, and not less than 10 or more than 30 ducks of the selected breed. One cock or cockerel must be kept for every 10 hens or pullets, and 1 drake for every 6 ducks.

(5) To provide proper housing where such does not already exist, and in case of two breeds being kept to provide a separate run for each to the satisfaction of the instructor or the department. The run for any one flock of 30 birds will require to be at least 300 square yards.

(6) To feed and care for the birds in such a manner and in such a way as the instructor and the department may require.

(7) To supply sittings of eggs from these birds to any person in the county at 1s. [24 cents] per dozen, and to replace infertile eggs that are returned within one month from the date on which they were sent out.

In special cases the department may sanction an increase in the price of eggs, provided the county committee show sufficient reasons for so doing.

(8) To stamp all eggs given out with a stamp provided for the purpose by the county committee.

(9) To keep in a special book, provided by the county committee, an accurate record of all eggs laid and distributed. This book must be sent to the secretary of the county committee or to the department when asked for by either of these bodies. The books should be returned to the secretary of the county committee at the end of the distributing season, which will commence on January 1 and terminate on May 31.

(10) To permit the instructor or the department to inspect the birds at any time. Any infringement of the above rules may entail the cancellation of the premium.

11. An additional grant of 50 per cent of the actual cost, but in no case exceeding £2 [\$9.73], may be made to the selected persons who provide themselves with portable wooden fowl houses approved by the department. This will only apply to persons that are taking up the scheme in 1903-04 for the first time.

Turkeys.

12. Premiums of £3 [\$14.60] each may be offered to persons who are prepared to comply with the following conditions:

(1) To keep one or more purebred American Bronze stock turkey cocks for the service of turkey hens, the property of any persons residing in the county, at a fee of 6d. [12 cents] per service. Each cock must serve 20 hens, exclusive of the owner's. If a smaller number are served, the premium will be proportionately reduced. The turkey cock will be required to be at least 12 months old and not less than 23 pounds in weight.

(2) To provide proper housing accommodation and to feed and care for the bird or birds in such a manner as the instructor or the department may require.

(3) To keep in a special book, provided by the county committee, an accurate record of services. This book must be sent to the secretary of the county committee or to the department when required, but otherwise returned to the secretary of the county committee at the end of the season, which will commence on January 1 and terminate on May 31.

(4) To permit the instructor or the department to inspect the birds at any time.

Any infringement of the above rules may entail the cancellation of the premium.

13. An applicant will be eligible for only one premium either for hens or for hens and ducks combined, but he will, in addition, be eligible to hold a premium for turkeys. No premium, however, will be given for ducks alone.

One of the following breeds of hens and ducks must be selected:

Laying breeds.

Minorcas. White Leghorns. Brown Leghorns.

General-purpose breeds.

Houdans. Plymouth Rocks. Orpingtons. Faverolles.

Ducks.

Aylesbury. Rouen. Pekin. Indian Runner.

14. As soon as the instructor has been appointed and the number of premiums proposed to be awarded has been approved of by the department, the county committee shall invite applications from persons in the county who already possess, or are willing to purchase, hens of approved pure breeds of fowls or ducks, or to keep one or more pure-bred turkey cocks, as above, and who are prepared to comply with the above conditions. When these applications have been received the county instructor in poultry keeping will, as soon as possible, inspect and report to the county committee as to the number of suitable applicants. The names of the selected applicants, with full particulars as to breeds, number of birds, and housing, should then be submitted for the approval of the department, who may thereupon further inspect the selected farms and submit a list of those of which they approve to the county committee for their final selection.

15. The department will not consider applications from a county in respect of premiums under this scheme later than December 1, 1903.

On account of the difficulty of procuring stock birds of pure breeds late in the season, it is recommended that county committees who intend to adopt this scheme should, if possible, have all arrangements completed prior to January 1, 1904.

16. Not later than June 10 the selected applicants for premiums should forward to the secretary of the county committee the record books referred to in clauses 10 (9) and 12, accompanied by a statutory declaration certifying that the entries in

these books are correct and that all the conditions of this scheme have been complied with.

As soon as the department is satisfied as to the fulfillment of the conditions of this scheme, the secretary of the county committee will be notified that payment may be made by the committee of the premiums or part premiums payable under this scheme.

Forms for the declaration required by this clause may be had on application to the secretary of the county committee.

17. No action shall be taken by the county committee towards putting this scheme, or any part thereof, into operation until the sanction of the department has been obtained in writing.

FRANCE.

GEOGRAPHICAL DISTRIBUTION OF POULTRY.

The earliest census of French poultry was taken in 1862 and has been followed by those of 1882 and 1892. In this period of thirty years the number of chickens has risen successively from 42,851,790 (1862) to 47,601,284 (1882) and to 54,102,985 (1892). The census of 1902 is not yet issued, but at the same percentage of increase the number of chickens for that year should amount to over 60,000,000. The census is taken near the end of the year (November 30) and gives what may be considered a constant figure, rising gradually from year to year. If taken earlier in the year, the census would no doubt show greater fluctuations. By the end of November the spring and summer stock are presumably sold off and the remainder is kept mainly for breeding and laying purposes.

Number and value of French poultry as given by the census returns of 1862, 1882, and 1892.

Kind of poultry.	1862.		1882.		1892.	
	Number.	Value.	Number.	Value.	Number.	Value.
Chickens	42,851,790	\$10,917,967	47,601,284	\$17,623,257	54,102,985	\$19,265,256
Geese	3,881,557	2,794,294	3,938,405	3,609,081	3,519,741	3,075,654
Ducks	3,610,841	1,219,651	4,184,250	1,799,888	3,683,727	1,525,904
Turkeys	1,760,506	1,726,070	2,095,697	2,214,867	1,968,142	1,974,588
Guinea fowls.....			271,637	166,961	300,509	200,911

This industry is distributed more generally than any other over the entire country. While the mountain tracts of the south and south-east are rather scantily supplied, poultry is grown considerably in the eastern and northern Departments.^a As might be expected, owing to the nearness of the great markets of London and Paris, poultry abounds in the Departments between Paris and the English Channel.

The Departments of France best supplied with poultry seem, on the one hand, to lie on a broad strip extending from Manche and the neigh-

^a See *Géographie Agricole de la France et du Monde*, by J. Du Plessis de Grenédan, p. 215 ff.

boring Departments south to the base of the Pyrenees. Another strip commences in the southeast and winds about Paris on the south and west as far as the Belgian frontier, taking in the Departments of Eure, Seine-Inférieure, Oise, Aisne, Somme, Pas-de-Calais, and Nord. The greatest number per acre exists in the Department of Seine, in which the capital (Paris) is located.

The following table will give some idea of the number of poultry per acre in different parts of the country in 1892:

	Per acre.		Per acre.
Seine	3. 26	Sarthe	0. 47
Nord	1. 14	Mayenne	. 44
Somme	1. 07	Pas-de-Calais	. 425
Saône-et-Loire	. 97	Pyrénées-Orientales	. 36
Rhin (Haut)	. 61	Var	. 26
Ille-et-Vilaine	. 51	Alpes-Maritimes	. 18

In the course of time France has developed several excellent breeds of chickens which are considered eminently adapted to the country. The most famous breeds are La Bresse, Houdan, Crèveœur, Flèche, and Faverolles. La Bresse breed abounds at Bourg in Ain and Louhans in Saône-et-Loire; Houdans at Hurepoix; Crèveœurs in the valley of the Auge; and La Flèche in Maine. The last named furnish the well-known poulards of Le Mans.

Ducks are found in great numbers in the western marshes, in the southwestern plains along the ocean, and particularly in Perigord, in the Charentes, and upper Poitou.

Geese are found in great numbers in Armagnac, lower Auvergne, le Bourbonnais, and La Bresse. Many are also raised in Poitou, where their livers are used in manufacturing pâté de foie gras (a pie made of fat goose livers).

Turkeys thrive on higher ground away from the sea. They are found in considerable numbers on the plains of the Garonne, beyond Bordelais, as well as in middle and eastern France.

THE CONDITIONS OF PRODUCTION.

France contains a great number of farms and small holdings. The census of 1892 states that there are 5,702,752 small holdings or farms. The great advantage of this system of small holdings is that the land is in the hands of the maximum number of proprietors and is able to support a very large rural population. The small size of the holdings compels the peasants to resort to intensive cultivation, and thus to make the most out of their land. Where an Englishman would emigrate to America or to the colonies and go into farming on a large scale, the French peasant would win a living by this intensive cultivation and thus be able to stay in his own country. The necessity of obtaining good results from small holdings of land has developed a large class of skilled farmers—what we might call agricultural arti-

sans. These conditions have produced the qualities of patience and skill and an almost fastidious care in the tilling of their small farms. The work is often laborious and not very remunerative, but they are able in this way to remain in France.

The average number of chickens per holding or farm is 9.48. Leaving out of account the State lands and the woods and forests, the cultivated area amounts to 34,720,200 hectares (\$5,797,614 acres), and gives 1.56 chickens per hectare, or 0.63 per acre. The number of persons who owned or rented the land they tilled was 4,814,870 in 1892. They raised an average of 11.24 chickens.

France is an agricultural country and produces an abundance of grain. The soil and climate are favorable to the keeping of poultry and the production of eggs. The subdivision of the land into numerous farms and small holdings has a tendency to enlarge the industry, and the nearness to London and Paris insures ready markets.

The care of the poultry is mostly in the hands of the farmer's wife. She looks to the comfort of her fowls and feeds them scraps and warm mash. The equal of the French peasant wife in industry and skillful management is not found in any other country. The large amount of money paid by Great Britain for French butter and eggs in excess of those of other nations is a direct tribute to the skill and industry of the French ménagères. They fear no rivalry from the English, as the English ladies will never condescend to this necessity; but they feel some anxiety as to whether they can keep the market from the Danes and the Russians.

The French eggs are large and brown and have an excellent flavor, and, being sorted, packed, and presented in the most attractive way, they bring the highest price in the English market. (See table on p. 426.) The largest eggs come from Picardy. Besides the extra size of the Picard eggs—being about as large as ordinary turkey eggs—they are considered to be of finer flavor and quality than those from other parts. The Normandy eggs come next.

Poultry raising is an important industry in Brittany. The cost of food, which consists principally of skim milk and barley meal, is not great. In fattening a simple device is used, it being a circular fattening pen of several tiers on a central pivot and an automatic "crammer." A woman is usually employed at this work at a cost of about 30 cents per day.

The eggs and poultry are collected at the local fairs and markets, and even at the farmhouses, by the dealer's cart as it goes on its weekly round. The eggs are packed for shipment in long, flat cases holding 60 dozens and which are easy to handle.

The Breton peasant himself is not a consumer of eggs, but he holds them for the collector, who in turn sells them to the local merchant, and finally the eggs find their way to St. Malo. In 1896 there were

exported from Cherbourg, Granville, Barfleur, and St. Malo 8,830 tons of eggs and 267 tons of fowls.

METHOD OF COLLECTING EGGS AT ST. MALO.

An important point in the egg industry is to bring the eggs to market in a fresh state. As a rule, a farmer does not find it worth his while to make an extra trip to town to deliver eggs, and if he does not happen to go to town the eggs remain at home to become stale, or are pickled for the winter, and in either case are sold at a reduced price. A British consul reports a simple plan of marketing eggs which is followed by the people in the vicinity of St. Malo, France. Women and boys collect the eggs at the farmhouses and cottages, pay for them in ready money, and take them to the nearest collector, who gives them an additional cent a dozen for their work. He either packs them himself or sends them to the packer at St. Malo. By this method several people make a living with little or no outlay, \$5 to pay for the eggs and a light wooden crate, carried by means of a webbing over the shoulders like a knapsack, being all they require. By this method the eggs arrive fresh on the market and bring a higher price than when they are kept long and delivered in a stale condition. The farmers and cottagers know that it is to the interest of the woman or boy to come at fixed dates, and they are glad to be saved all expense and risk of sale. Any man well known in the vicinity can start this method of collection by employing old men and boys. If a collector purchases even 50 dozen eggs in a day, his pay is 50 cents, and he is thus insured a pretty fair living.

PRODUCTION AND CONSUMPTION OF POULTRY.

The census taken on November 30, 1892, gives the number of chickens as 54,102,985. The stock was at this time near the minimum number after the slaughter of the summer stock. What proportion this number is to the total when the flocks were most numerous there are no data to determine. The *Statistique Agricole, Résultats Généraux de l'Enquête Décennale de 1892*, page 315, suggests the following method: The writer assumes that the total stock of the country remains nearly constant from year to year, and that the average life of a chicken is one year and a half. Dividing the census total by one and a half he obtains 36,068,650 as the number of chickens consumed annually. In other words, the number killed in each year is equivalent to the new crop of the season. Thus a farmer having 150 chickens would on the average dispose of 100 a year. The writer does not state on what observations he bases his method.

At present the proportion of poultry consumed during the year is greater than it was in 1892, but that is no doubt due to the rise in the

price of meat. The exports of poultry give only a small fraction of the total product of the poultry yard. To this we must add not only the number that is sold in the towns and cities, but also that consumed in the country itself by the producers. But what the percentage of each one of these items may be is not easy to ascertain.

THE POSSIBILITIES OF IMPROVEMENT.

Although the poultry industry is probably better organized in France than in most other countries, yet much could be done to improve existing conditions. More effective organization will probably be introduced, this being necessary in order to compete successfully with a country like Denmark, which has most thorough organization. France has natural advantages in the climate, soil, aptitude of the people for this work, and proximity to great markets, both domestic and foreign.

The Danish cooperative system has been introduced into France only to a limited extent, but many are urging its adoption.

IMPORTS AND EXPORTS OF POULTRY.

The imports and exports of live poultry are not large, both amounting to only about half a million dollars a year. The trade in dead poultry, on the other hand, is more important and amounts to over \$2,000,000 a year. The exports exceed the imports five or six times.

Ireland supplies only her own demands. Denmark is obliged to import for her own use, and the same is the case with the other neighboring countries. Of the more remote countries Russia is the largest exporter to England, the value of the exports amounting to \$800,529 in 1898. Canada and Italy also ship large quantities. The quality of this poultry is not the best, and the freezing or cold storage resorted to in transporting them to great distances does not improve their flavor. Under these conditions it would not be as profitable for the French to compete in the same grade of exports. Cheap trade is not the most profitable. The extra expense entailed in producing a fine quality is trifling, while it often doubles the price in the market. The total exports of Russian poultry amount to a large sum, but the net gain is probably small. The French exports are not so large, but the profits are large. The Mans and Bresse pullets, owing to their superior quality, make the industry profitable. For this reason they have no ambition to vie with Russia in the quantity of their exports, and only seek to develop this high-class trade—this commerce de luxe—which they now possess and which is so profitable. They devote their skill to producing poultry of exquisite quality and flavor; and the great success of the French at the annual poultry exhibitions held in the Agricultural Hall, London, is evidence of the merit of their products.

Its nearness to London gives France an advantage over its competitors. Most of the poultry and eggs that are exported come from the north of France, which has excellent facilities for shipping into England. For example, the Western Railway of France sends five days in the week the so-called "butter train," which gathers butter, eggs, and poultry along the route and arrives at Cherbourg at 5 in the evening. Steamers leave at 11.30 in the night and the train arrives in London in the early morning. Thus eggs collected in France may be had in London the next morning.

The east counties of England used to produce a great many turkeys, but the consumption there has now exceeded the production, and England has recourse to France, Italy, and Canada. France ships two kinds of turkeys—the Sologne and the Normandy. The meat of the latter is more tender, has a better flavor, and brings a somewhat higher price in the market. French turkeys are slaughtered after fasting twenty-four hours, and then packed in clean, returnable cases; they reach the market in perfect condition.

Goose is the traditional Christmas bird of the English, and at this joyous season the English consume them in enormous quantities. The supply comes almost altogether from France, and during Christmas week London alone consumes from 100,000 to 150,000 French geese. The Department of Sarthe occupies the first place in the production of geese. These are of medium weight and much relished. The huge Toulouse geese are not in so great demand. In recent years the tendency has been to raise geese weighing from 9 to 12 pounds. English buyers complain that they can not in England or Ireland obtain 500 geese of uniform weight, while they can buy 5,000 in France and have them delivered on a certain date. Two hundred English geese would vary in weight from 6 to 16 pounds.

FRENCH EXPORTS OF EGGS.

The French exports of eggs (see pp. 453, 454) show a considerable decline during the "nineties," and several explanations of this fact have been offered. Some have assumed that with the introduction of the cooperative methods eggs of better quality have been produced elsewhere, and that these have forced a great number of the French eggs out of the market and taken their place. That the eggs of other countries have replaced the French eggs on some markets does not prove the superiority of the former is easily shown by the fact that the French eggs have now, as well as heretofore, brought the highest prices in the foreign markets. They are large, brown, and of excellent flavor, being in especial favor with the wealthy. The great quantity of cheaper eggs that enter the English markets is consumed by a very large class of people who can not afford to use the French product.

The cooperative method has done a great deal to increase the production and quality of eggs, but, after all deductions are made, such methods can not produce a favorable climate or soil or deprive the French peasant's wife of her native industry and skill. Others have supposed that the Italian exports to southern France have been replaced by French eggs, and that many of the Italian eggs that formerly went to Great Britain by way of France have in recent years passed through Belgium. The statistics, however, do not bear out this statement, as the imports from Italy into France have grown slightly instead of decreasing. When we examine the table of exports of French eggs, we see that the decline is not confined to one year or even to recent years, but covers a period of some twenty years. The explanation of the decline in 1897 then must be taken, not as a separate instance, but in connection with a cause of long duration, with a regular decline that has operated since about 1880.

In order the better to understand the course that the export trade of French eggs has taken, it will be important to discuss the rise of this trade.

The exportation of French eggs seems to have commenced about 1830—fifty years before any other country seriously thought of this source of income. England has been the chief market and France has the advantage of being near by. As early as 1838 the exports of French eggs to all countries had a value of 5,000,000 francs. During the five years of 1838 to 1842 the average annual exports of French eggs amounted to 5,600,000 francs. The highest point was reached in 1875, when they amounted to 34,417,000 kilos and were valued at 46,463,000 francs, or 1.35 francs (26 cents) per kilo. This amount is about twice that of 1897. The great bulk goes to England, only a mere fraction being sent to other countries.

Previous to 1880, for some forty or fifty years, France had undisputed supremacy in the egg markets of England. Other countries of large production exported elsewhere. For instance, Italy sent her eggs to Germany, France, and Switzerland; Russia exported to Germany. An idea of what these countries were exporting in 1880 may be had from the following table:

Exports of eggs from leading countries in 1880.

Country of export.	Quantity.		Value.
		<i>Dozens.</i>	<i>Dollars.</i>
France.....kilos..	21,413,932	^a 35,689,887	5,885,044
Italy.....quintals..	250,969	41,828,162	8,072,835
Russia.....stook..	127,047,000	10,587,250	929,060
Belgium.....			816,969
Denmark.....scores..	1,992,055	3,320,092	520,483

^a About.

France first found Italy as a competitor in the English market in 1883, and since that date large quantities of Italian eggs reach England by way of Belgium. Russia appears to have entered this market about 1883, when she sent 67,460 dozens.

WHY FRANCE HAD LED IN EGG EXPORTS.

The preponderance of French eggs in the English market is to some extent due to the fact already stated, that the country is very favorably located as regards the English market, but it is due principally to the fact that the French were the first to organize this industry. Other countries were geographically as near England then as now, and could have taken much of the trade had the industry been better developed among them. So long, however, as the methods of transportation were comparatively undeveloped, it was hardly possible to ship eggs from Russia, Italy, or the Balkan States, but Ireland, Belgium, Holland, Denmark, and Germany were as favorably situated as many parts of France.

The situation was that the British market demanded a good and clean supply, and the French had the skill and aptitude to satisfy that demand. The English were the best customers for eggs in Europe, and during the decade between 1880 and 1890 the different European countries, one by one, entered this market with ever-increasing imports; but France continued easily as first. In the next decade the struggle became more acute. Denmark had in the meanwhile perfected a cooperative system for this industry, and other countries had adopted similar improvements. With improved methods of collecting, packing, and transporting, a larger area was taken in and could compete in the best markets. This stimulated local prices and at the same time increased the exports.

In the twenty years following 1880 Denmark increased her egg exports to England sixfold; Russia between 1888 and 1901 increased hers threefold. In the face of this competition it is not to be expected that France could make a successful stand for any length of time. The Danish exports to England are increasing from year to year, as are those from other continental lands, but up to almost the close of the century France was the largest exporter of eggs to England, and she held the trade of London almost exclusively. In 1897 the French exports were surpassed by Russia in volume though not in value. The Belgian and German exports are also larger, but as those exports in reality come from other countries, such as Russia, Austria-Hungary, the Balkan States, and Italy, they should not be considered as the product of the countries exporting them. They are, in fact, reexports from the countries named.

Thus we see that a constantly growing improvement in the methods of collecting, packing, and shipping, and a better knowledge of the

principles of the cooperative system have enlarged the area of the competitive trade and resulted in an enormous increase in the exports of eggs from the agricultural countries.

The development of the industry in countries like Denmark, Russia, and Hungary brings about large exports from those places, and naturally so; but it is difficult to understand why the French exports are decreasing, especially since the demand of the English market is constantly growing. Since 1880, for instance, the imports into the United Kingdom have grown threefold—from 62,284,050 dozens to 189,667,950 dozens in 1902. One of the reasons for this decline of French exports, it has been stated, is that the consumption by the people of France has increased more rapidly than production. Better prices are now obtained in Paris than could be obtained in London. Moreover, this trade is not so profitable as it has been—not so profitable as other kinds of exports.

The following table shows the imports and exports of eggs for the years of 1877 to 1902, inclusive. The table also shows the exporting country:

Imports and exports of French eggs, 1877 to 1902.^a

[From Tableau Décennal du Commerce de la France, 1877-1896; Tableau Général du Commerce, 1896-1902.]

IMPORTS.

From—	1877.	1878.	1879.	1880.	1881.	1882.
	<i>Kilograms.</i>	<i>Kilograms.</i>	<i>Kilograms.</i>	<i>Kilograms.</i>	<i>Kilograms.</i>	<i>Kilograms.</i>
Germany	311,765	457,314	445,667	624,639	514,423	868,357
Belgium	1,597,518	1,761,648	1,877,121	2,055,292	2,365,041	2,158,496
Austria	195,017	89,480	350,679	346,846	97,441	270,467
Italy	3,789,918	3,551,625	4,532,169	3,966,376	4,135,631	4,497,006
Other countries	172,642	447,313	277,093	163,865	139,217	324,093
Total quantity	6,066,860	7,482,729	7,482,729	7,157,018	7,251,756	8,119,018
Value	\$1,639,266	\$1,643,390	\$1,949,625	\$1,864,761	\$1,889,445	\$2,193,759

From—	1883.	1884.	1885.	1886.	1887.
	<i>Kilograms.</i>	<i>Kilograms.</i>	<i>Kilograms.</i>	<i>Kilograms.</i>	<i>Kilograms.</i>
Germany	1,049,397	1,326,839	861,208	937,114	493,070
Belgium	2,871,593	2,793,331	3,168,574	3,011,938	3,362,547
Austria	816,889	179,138	326,347	236,762	135,431
Italy	4,087,722	3,925,376	4,163,064	4,565,496	3,658,552
Turkey					299,122
Other countries	191,991	306,293	938,917	304,473	551,820
Total quantity	8,517,592	8,530,977	9,098,110	9,145,773	8,700,542
Value	\$2,383,648	\$2,387,394	\$2,370,513	\$2,206,418	\$2,016,045

^a In France it is estimated that, on an average, 20 eggs equal 1 kilogram = 2.20 pounds.

Imports and exports of French eggs, 1877 to 1902—Continued.

IMPORTS—Continued.

From—	1888.	1889.	1890.	1891.	1892.
	<i>Kilograms.</i>	<i>Kilograms.</i>	<i>Kilograms.</i>	<i>Kilograms.</i>	<i>Kilograms.</i>
Germany	775,421	724,143	932,471	873,425	556,885
Belgium	3,251,998	2,827,718	3,523,323	3,898,042	3,082,140
Austria	297,514	645,583	561,128	618,792	134,446
Italy	2,020,298	1,122,749	996,584	1,003,389	1,387,451
Turkey	482,897	1,102,211	1,904,688	1,852,110	928,192
Other countries	933,625	1,191,125	1,299,023	1,347,622	396,634
Total quantity	7,761,753	7,613,529	9,217,167	9,593,380	6,485,748
Value	\$1,797,622	\$1,763,293	\$2,134,696	\$1,646,374	\$1,152,110

From—	1893.	1894.	1895.	1896.	1897.
	<i>Kilograms.</i>	<i>Kilograms.</i>	<i>Kilograms.</i>	<i>Kilograms.</i>	<i>Kilograms.</i>
Russia					2,513,794
Germany	833,845	1,035,661	894,826	517,661	346,569
Belgium	3,038,887	3,718,348	3,679,927	3,967,524	4,306,976
Austria	387,171	637,909	421,641	469,296	436,400
Italy	1,505,405	2,980,369	1,756,962	1,788,236	2,240,077
Turkey	599,692	1,419,990	1,648,891	1,708,513	1,827,072
Egypt					152,039
Tripoli					129,300
Other countries	276,693	1,071,519	1,410,667	1,817,012	145,778
Total quantity	6,641,693	10,863,796	9,302,914	10,268,242	12,097,990
Value	\$1,299,793	\$2,044,295	\$1,540,507	\$2,009,516	\$2,294,751

From—	1898.	1899.	1900.	1901.	1902.
	<i>Kilograms.</i>	<i>Kilograms.</i>	<i>Kilograms.</i>	<i>Kilograms.</i>	<i>Kilograms.</i>
Russia	2,199,097	2,562,282	3,506,087	3,728,292	4,306,348
Germany	1,348,769	862,699	808,062	960,044	1,444,488
Belgium	5,229,882	5,249,193	4,905,463	4,827,306	5,137,094
Austria	534,618	289,884	228,310	472,832	1,008,127
Italy	2,453,542	2,942,981	2,368,502	2,373,188	2,645,862
Turkey	2,007,358	2,034,499	2,649,254	3,249,930	4,494,952
Egypt	312,270	267,096	543,267	208,542	154,406
Tripoli	103,919				
Other countries	355,016	212,708	289,942	491,122	980,534
Total quantity	14,544,471	14,421,342	15,298,887	16,311,256	20,171,811
Value	\$2,977,754	\$3,082,804	\$3,408,579	\$3,560,470	\$4,251,830

Imports and exports of French eggs, 1877 to 1902—Continued.

EXPORTS.

To—	1877.	1878.	1879.	1880.	1881.	1882.
	<i>Kilograms.</i>	<i>Kilograms.</i>	<i>Kilograms.</i>	<i>Kilograms.</i>	<i>Kilograms.</i>	<i>Kilograms.</i>
England	26,194,976	25,619,930	22,886,698	20,786,472	20,442,753	18,948,871
Germany	192,381	197,308	174,742	149,187	143,003	126,195
Belgium	429,571	234,388	236,521	121,030	153,372	182,318
Spain	15,790	50,211	227,860	40,860	14,198	26,392
Switzerland	237,942	243,366	240,292	272,659	265,061	268,379
Other countries	51,375	48,737	37,295	43,724	34,048	58,993
Total quantity	27,122,035	26,393,735	23,803,408	21,413,932	21,052,435	19,611,148
Value	\$7,328,374	\$6,876,940	\$4,363,859	\$5,786,044	\$5,688,368	\$5,488,180

To—	1883.	1884.	1885.	1886.	1887.
	<i>Kilograms.</i>	<i>Kilograms.</i>	<i>Kilograms.</i>	<i>Kilograms.</i>	<i>Kilograms.</i>
England	20,180,963	19,944,154	20,294,977	20,472,314	21,968,998
Germany	108,196	103,174	102,908	96,741	.....
Belgium	194,911	262,655	372,704	271,809	227,131
Spain	412,172	170,458	255,723	187,605	208,407
Switzerland	274,326	311,838	330,706	312,181	377,120
Other countries	168,309	80,670	109,235	102,917	213,406
Total quantity	21,338,877	20,872,949	21,466,253	21,443,567	22,996,052
Value	\$5,971,685	\$5,841,295	\$5,598,082	\$5,173,261	\$5,325,654

To—	1888.	1889.	1890.	1891.	1892.
	<i>Kilograms.</i>	<i>Kilograms.</i>	<i>Kilograms.</i>	<i>Kilograms.</i>	<i>Kilograms.</i>
England	18,368,557	20,657,282	21,098,520	22,286,231	22,313,928
Belgium	80,791	120,172	150,887	211,049	141,258
Spain	784,414	977,503	861,933	951,676	415,795
Switzerland	345,517	333,795	352,493	368,265	353,618
Other countries	203,510	194,067	215,646	199,499	358,630
Total quantity	19,782,789	22,282,819	22,679,479	24,016,720	23,583,236
Value	\$4,581,694	\$5,160,701	\$5,252,567	\$4,121,644	\$4,189,260

To—	1893.	1894.	1895.	1896.	1897.
	<i>Kilograms.</i>	<i>Kilograms.</i>	<i>Kilograms.</i>	<i>Kilograms.</i>	<i>Kilograms.</i>
England	24,500,582	12,755,098	16,999,013	21,467,453	17,126,299
Germany .....	.....	.....	.....	.....	84,733
Belgium	56,434	41,147	49,730	46,769	40,230
Spain	229,283	685	6,534	1,392	.....
Switzerland	326,952	194,755	234,753	329,871	291,817
Italy .....	.....	.....	.....	.....	4,492
Other countries	160,178	201,153	247,726	518,627	62,168
French vessels .....	.....	.....	.....	.....	147,117
Total quantity	25,273,129	13,192,838	17,537,756	22,364,114	17,759,856
Value	\$5,706,993	\$2,879,772	\$3,564,181	\$4,309,368	\$3,341,961

Imports and exports of French eggs, 1877 to 1902—Continued.

EXPORTS—Continued.

To—	1898.	1899.	1900.	1901.	1902.
	<i>Kilograms.</i>	<i>Kilograms.</i>	<i>Kilograms.</i>	<i>Kilograms.</i>	<i>Kilograms.</i>
England.....	12,440,617	12,183,691	12,343,336	10,998,383	9,497,574
Germany.....	96,601	93,428	110,160	128,673	126,808
Belgium.....	17,944	14,250	39,512	29,467	37,066
Switzerland.....	228,658	202,383	270,629	286,344	238,456
Italy.....	5,456	1,610	.....	3,222	296
Other countries.....	48,189	56,846	52,200	50,779	71,067
French vessels.....	146,062	163,277	179,941	438,040	331,643
Total quantity.....	12,963,517	12,714,935	12,995,778	11,934,858	10,302,918
Value.....	\$2,638,627	\$2,698,890	\$2,895,545	\$2,784,844	\$2,481,602

LIVE AND DEAD POULTRY.

French imports and exports of live and dead poultry, 1877 to 1903.

LIVE POULTRY.

Year.	Imports.		Exports.	
	Quantity.	Value.	Quantity.	Value.
	<i>Kilograms.</i>	<i>Dollars.</i>	<i>Kilograms.</i>	<i>Dollars.</i>
1877.....	.....	865,742	.....	687,392
1878.....	.....	845,198	.....	676,377
1879.....	.....	1,021,258	.....	773,066
1880.....	.....	971,925	.....	756,773
1881.....	3,129,842	1,208,119	3,370,207	1,300,881
1882.....	3,345,279	1,291,285	3,512,973	1,356,008
1883.....	2,666,409	1,029,233	3,735,734	1,441,998
1884.....	2,653,664	998,706	2,829,344	1,064,824
1885.....	2,814,942	1,059,403	4,294,998	1,616,422
1886.....	2,806,534	1,056,239	3,014,436	1,134,483
1887.....	2,837,146	1,040,381	3,494,092	1,281,384
1888.....	2,215,512	816,588	3,091,818	1,192,442
1889.....	1,915,371	776,300	2,400,465	972,909
1890.....	1,950,120	809,202	2,338,884	970,520
1891.....	1,890,297	802,619	2,349,198	997,470
1892 ^a	933,866	306,401	1,256,326	412,201
1893.....	868,668	267,255	1,142,611	352,838
1894.....	1,247,093	385,102	776,962	254,921
1895.....	1,219,226	341,301	809,622	242,198
1896.....	1,185,316	320,272	688,321	199,269
1897.....	1,227,518	324,568	534,617	151,976
1898.....	1,276,421	357,207	493,806	149,722
1899.....	1,337,956	361,516	703,843	204,663
1900.....	1,276,317	361,104	570,228	171,385
1901.....	1,143,985	324,560	508,180	153,984
1902.....	1,167,476	333,478	1,503,940	439,035
1903 ^b	1,027,400	293,550	496,300	151,312

^a Previous to 1892 game and turtles were included with poultry.^b Preliminary figures.

French imports and exports of live and dead poultry, 1877 to 1903—Continued.

DEAD POULTRY.

Year.	Imports.		Exports.	
	Quantity.	Value.	Quantity.	Value.
	<i>Kilograms.</i>	<i>Dollars.</i>	<i>Kilograms.</i>	<i>Dollars.</i>
1877.....	2,557,208	1,115,408	2,512,409	1,095,862
1878.....	2,899,842	1,315,223	2,563,101	1,162,494
1879.....	3,486,000	1,749,275	2,924,015	1,467,271
1880.....	3,450,389	1,598,220	3,616,355	1,675,096
1881.....	3,325,359	1,476,127	2,640,978	1,172,330
1882.....	3,851,565	1,724,577	2,881,078	1,290,032
1883.....	3,484,489	1,546,765	2,511,312	1,114,771
1884.....	3,712,071	1,576,145	2,610,208	1,108,294
1885.....	3,859,841	1,638,888	2,503,523	1,062,996
1886.....	3,457,008	1,467,846	2,712,100	1,151,558
1887.....	3,732,596	1,548,816	3,362,688	1,395,347
1888.....	3,425,638	1,487,583	3,236,557	1,405,475
1889.....	3,407,741	1,545,581	3,545,584	1,608,100
1890.....	3,442,483	1,594,558	3,897,435	1,805,292
1891.....	3,194,302	1,510,426	3,769,755	1,782,529
1892 ^a	844,576	391,208	3,957,251	1,871,186
1893.....	746,009	331,153	4,319,823	1,969,256
1894.....	984,954	437,221	3,296,624	1,558,832
1895.....	936,060	379,385	3,159,324	1,371,936
1896.....	901,841	348,111	5,115,062	2,122,495
1897.....	928,226	349,338	3,790,999	1,536,492
1898.....	942,029	372,713	4,118,838	1,748,859
1899.....	951,442	367,257	4,510,979	1,871,831
1900.....	939,643	380,837	4,653,833	2,020,927
1901.....	954,699	386,440	4,751,328	2,063,264
1902.....	489,626	149,307	4,560,570	1,980,428
1903 ^b	917,500	178,911	5,053,900	2,194,603

^a Previous to 1892 game and turtles were included with poultry.^b Preliminary figures.

PÂTÉ DE FOIE GRAS.

French imports and exports of pâté de foie gras, 1892 to 1903.

Year.	Imports.		Exports.	
	Quantity.	Value.	Quantity.	Value.
	<i>Pounds.</i>	<i>Dollars.</i>	<i>Pounds.</i>	<i>Dollars.</i>
1892.....	79,657	69,735	201,470	176,375
1893.....	101,182	88,579	248,974	217,963
1894.....	101,185	88,581	225,822	197,694
1895.....	92,385	80,879	214,951	188,177
1896.....	92,807	81,247	254,201	222,539
1897.....	90,638	79,348	208,520	182,547
1898.....	83,182	72,821	196,574	172,090
1899.....	74,793	65,477	212,878	186,363
1900.....	74,244	64,997	222,501	212,157
1901.....	65,904	57,695	204,433	178,969
1902.....	46,720	40,901	204,990	179,457
1903 ^a	26,400	50,952	122,100	235,653

^a Preliminary figures.

THE CONSUMPTION OF EGGS IN PARIS.

The number of eggs consumed in a large city like London or Paris is a question that has attracted some attention in recent years. London does not publish any satisfactory data on this subject; Paris, however, gives full and extensive information, and, being the largest city on the Continent, it will perhaps serve a useful purpose for comparison. Although the amount of eggs consumed will no doubt vary to some extent in different cities and the statistics for one can not be applied with accuracy to another, yet it is true that correct information in regard to one city of the first rank, such as Paris, will serve as a check to the wild guesswork often found in periodicals.

CITY AND MARKET REGULATIONS.

The city government levies a small tax on all eggs that enter the city limits, and from the records of this transaction it becomes possible to ascertain the total receipts of eggs in Paris.^a This tax, or octroi, as it is called, amounts to 81 cents per 100 kilos. About one-third of the eggs, both foreign and domestic, go to private dealers in the city. The remainder is taken by the Halles Centrales (Central Market), where the sale is subject to municipal regulations. The market fee for eggs is 20 cents per 100 kilos. The common package (colis) for French eggs is a wicker basket containing 1,000, while the long foreign cases hold 440 more. As the consignments usually contain some spoiled and small eggs, there is a board of inspectors appointed by the prefect of police to ascertain the number and condition of the eggs.

The cost of counting 1,000 eggs is about 5 cents; of testing, about 12 cents; and of passing through the ring, or grading, about 3 cents. Inspectors make no charge, however, for grading if there are fewer than ten small eggs in a consignment. An egg passing through a ring having a diameter of 38 mm. (about 1½ inches) is considered small. The inspectors act independently of buyers and sellers, and the police seize all eggs that are unfit for consumption. The number so seized is about 1 in every 50. The cost of counting and testing is borne by the purchaser when the loss falls below 10 in the count and 15 eggs in the test, otherwise the seller makes good the loss. The commission men charge 3 per cent for handling the eggs; they sell about 40 per cent by auction and 60 per cent by contract.

An ordinance of April 23, 1897, forbids the importation of merchandise not coming directly from the places of shipment or production. This has had the effect of eliminating preserved or limer eggs, which were bought up when they were abundant and preserved and resold at times when the supply was scarce. The items of preserved eggs given in the official reports before this date have not appeared since.

^a *Annuaire statistique de la Ville de Paris.*

THE SOURCES OF SUPPLY.

Nearly all the receipts of eggs in the Halles Centrales are domestic. Only about one one-fifteenth is foreign. As the foreign eggs are smaller, requiring from 25 to 30 to make a kilogram, they bring from \$1.54 to \$1.93 less per 1,000 than French eggs. The table below gives the domestic and foreign sources of the supply of the market in 1897:

<i>Sources of supply of eggs for the Paris market for 1897.</i>		Kilograms.
France:		
West—Normandy, Brittany.....		4, 555, 301
Lyons—Burgundy, Bourbonnais		1, 346, 234
North—Picardy		1, 452, 982
East—Brie, Champagne.....		737, 300
Orleans—Beauce, Orne, Châtellerault, Nivernais, Vendée, Midi.....		6, 503, 600
Paris—Private parties.....		372, 626
Preserved—South and west		204, 800
Foreign:		
Austria-Hungary		57, 980
Egypt		56, 459
Germany		209, 680
Russia.....		708, 144
Spain.....		5, 100
Tunis.....		217, 020
Turkey.....		23, 100
Total.....		16, 450, 326

The average price for 1,000 eggs in 1897 was \$16.81. The average price per kilogram for the same year was 27.6 cents. A kilogram represents about 15 large, 17 medium, or 22 small eggs. As the different grades do not enter in the same proportion into the total receipts, the official estimate is 20 eggs to the kilogram.

TOTAL RECEIPTS AT PARIS.

The total supply of Paris was 20,566,873 kilograms in 1885, 22,324,103 kilograms in 1890, 24,589,962 kilograms in 1895, and 30,732,964 kilograms in 1900. This last figure should be discounted somewhat, as the increase is beyond the normal and was due to the occurrence of the world's exposition in that year. We see from these figures that there is a normal increase of about half a million a year. The home production supplies nearly all the demand. In the late fall and winter, when French eggs are more scarce than at any other time, foreign eggs make up the deficiency, but seldom appear on the market during the summer season. The duty on eggs is \$1.93 (general tariff) or \$1.16 (special tariff) per 100 kilograms; a few eggs come in at the general tariff of \$1.93, while the great mass enter at the conventional rate of \$1.16 per 100 kilograms. The records of the port of Paris give the amount of foreign eggs subject to tariff. From about

1,000,000 kilograms in 1890 it had grown to 4,000,000 kilograms in 1900. Foreign eggs, as a rule, are small, requiring from 25 to 30 to the kilogram, as stated above, and they bring from \$1.54 to \$1.93 less per 1,000 than the domestic. They also come, as a rule, by slow freight and are from three to eight days old when they arrive.

At first the imports seem to have come from a few near-by countries, but as the years went by they were shipped from greater and still greater distances. About 1890 Austria-Hungary was the only country exporting to Paris. Soon Russia, Germany, and Italy came in. Egypt appeared for the first time in 1896 and Tunis and Turkey in the following year. Russia has gradually outstripped the others. The seizures by the police in the Central Market since 1892 average 30,529 kilograms and the reshipments 992,111 kilograms. It should be observed, however, that the reshipments have in the same period decreased from about 1,215,000 to 684,100 kilograms. Therefore, after deducting the seizures by the police and the reshipments, the per capita consumption in 1891 was 180.6; in 1896 it was 193.6; and in 1900 it was 221. As already stated, some deduction should be made for the exposition year of 1900.

The table below shows for the year of 1897, by months, the total receipts of eggs at Paris and also the amount of these that went to the Central Market. The difference between the total receipts and those that went to the Central Market are the eggs that went to private dealers:

Receipts of eggs at Paris in 1897, by months.

Month.	Total receipts at Paris.	Receipts of foreign origin.	Receipts at Halles Centrales (Central Market).		
			Of domestic origin.	Of foreign origin.	Total.
	<i>Kilograms</i>	<i>Kilograms</i>	<i>Kilograms</i>	<i>Kilograms.</i>	<i>Kilograms.</i>
January	1,534,809	.....	1,138,687	118,100	1,256,787
February	2,222,594	.....	1,538,648	10,430	1,549,078
March	3,553,158	.....	2,238,455	6,700	2,245,155
April	3,472,453	.....	1,883,573	.....	1,883,573
May	2,562,925	.....	1,533,123	.....	1,533,123
June	2,099,699	.....	1,320,893	.....	1,320,893
July	2,108,781	.....	1,277,035	.....	1,277,035
August	1,730,659	.....	1,045,766	3,700	1,049,466
September	1,696,713	.....	842,599	126,260	968,859
October	1,873,658	.....	784,536	356,176	1,140,712
November	1,675,375	.....	757,100	290,048	1,047,148
December	2,018,818	.....	812,428	366,069	1,178,497
Total	26,528,642	2,820,500	15,172,843	1,277,483	16,450,326

Table showing maximum and minimum prices per 1,000 eggs of the several grades at the Central Market, Paris, by months.

Month.	Extra size (15 per kilogram).		Medium size (17 per kilogram).		Small size (22 per kilogram).	
	Maximum.	Minimum.	Maximum.	Minimum.	Maximum.	Minimum.
1897.						
January	\$25.56	\$22.10	\$21.09	\$18.65	\$16.90	\$13.27
February	23.47	20.86	19.17	16.71	15.81	12.99
March	18.67	16.36	15.37	13.24	12.21	9.61
April	18.23	15.91	15.22	13.24	11.56	8.95
May	17.12	15.29	13.84	11.74	9.91	8.39
June	18.09	16.58	14.47	12.13	11.05	8.59
July	19.70	17.47	15.97	13.60	11.66	9.12
August	22.42	19.47	18.05	15.24	14.10	10.42
September	23.88	20.41	17.67	15.88	13.79	9.95
October	28.18	24.75	21.81	17.37	14.75	10.75
November	30.72	26.66	23.10	18.10	15.22	12.47
December	30.05	26.08	22.85	18.03	15.68	12.81
Average	23.01	20.16	18.22	15.33	13.56	10.61
1900.						
January	28.13	24.95	21.42	18.83	16.10	12.79
February	24.59	21.81	19.09	16.71	14.01	11.14
March	19.84	17.58	15.55	13.55	11.63	9.08
April	18.83	16.86	14.86	12.81	11.11	9.43
May	19.37	17.34	15.41	13.47	11.55	9.10
June	21.09	18.24	16.09	13.67	11.56	9.09
July	21.94	18.96	16.65	14.27	12.16	9.75
August	25.37	21.23	18.07	15.90	13.40	10.24
September	25.01	22.06	18.76	15.69	12.28	9.40
October	28.82	25.05	22.45	19.30	15.07	12.35
November	31.61	26.14	22.88	18.99	15.42	11.19
December	32.04	27.17	22.52	18.82	15.47	11.98
Average	24.76	21.45	18.65	16.00	13.31	10.46

Table showing the imports of eggs, both domestic and foreign, into Paris for a series of years.

Year.	Eggs of domestic origin.	Eggs of foreign origin.	Total.	Reshipments (about).
	Kilograms.	Kilograms.	Kilograms.	Kilograms.
1885			20,566,873	
1886			20,721,599	1,009,100
1887			21,405,044	909,100
1888	20,739,985	729,900	21,469,885	900,000
1889	21,610,372	969,700	22,780,072	1,200,000
1890	21,176,203	1,147,900	22,324,103	1,110,000
1891			23,250,509	
1892			23,432,947	1,215,000
1893	22,378,265	1,170,900	23,549,165	1,110,000
1894	22,194,896	2,283,700	24,478,596	1,140,000
1895	23,035,264	1,554,700	24,589,962	1,120,000
1896	23,200,602	2,468,500	25,669,102	1,185,900
1897	23,708,142	2,820,500	26,528,642	901,900
1898	23,675,556	3,239,400	26,914,956	863,600
1899	25,236,622	4,006,300	27,242,922	771,900
1900	26,602,544	4,129,700	30,732,964	684,100
1901		5,219,500		
1902		7,219,100		

The following table shows what disposition is made of these eggs. The Central Market (Halles Centrales) alone makes a separate showing of the domestic and foreign produce:

Distribution and price of eggs received at Paris for a series of years.

Year.	Central market.		Private dealers.	Seized by police.	Price per kilo-gram.	Price per 1,000 eggs.
	Of domestic origin.	Of foreign origin.				
	Kilograms.	Kilograms.	Kilograms.	Kilograms.	Francs.	Francs.
1885			4,580,284		1.36	
1886			5,588,776			
1887			6,157,895			
1888			6,278,788	37,031		
1889	15,499,645	502,894	6,777,533	36,657		
1890	14,544,590	573,690	7,305,823	35,586		
1891	15,288,861	441,832	7,519,815			
1892	15,741,065	290,344	7,401,538	32,743		
1893	15,416,031	632,965	7,500,169	33,108		
1894	15,082,752	1,318,946	8,076,898	30,624	1.33	81.69
1895	15,447,440	541,200	8,601,324	30,638	1.43	87.21
1896	15,637,814	930,200	9,101,088	28,081	1.41	85.05
1897	15,172,843	1,277,483	10,078,316	28,719	1.43	87.12
1898	14,058,199	1,955,376	10,901,381	30,039	1.45	89.59
1899	13,764,214	2,494,380	10,983,622	30,981	1.46	81.03
1900	15,528,433	2,606,160	12,579,651	31,790	1.48	80.91

ITALY.

Agricultural cooperation, along the lines followed in Denmark and Ireland, is unknown in Italy, except in Lombardy and Venetia, where some attempts have been made with excellent results. The general principle governing these cooperative societies, or unions, is, first, the establishment of local unions; these have their head in a central union. There are about 300 such unions, and they have a membership of about 45,000. The unions and their membership are increasing. Instructors are appointed to travel from place to place to give such advice as seems necessary. No unions have yet been established to lend support to the poultry and egg industry, those so far organized being for the purpose of purchasing fertilizers and other things needed on the farm. It is probable that the success of the unions in other lines will soon suggest the value of their work in the interests of poultry and egg production.

The statistics of imports and exports which have been compiled for Italy relate to special commerce; that is, the imports are those for consumption only and the exports are those of domestic origin.

The imports of eggs have never been on a large scale; the largest amount was in 1902, when their value was \$244,251. So far as the statistics compiled for this article show, there has always been a heavy

export trade in eggs. This trade was worth \$6,781,182 in 1880, while in 1902 the value was \$8,310,821. This amount was exceeded by the three years immediately preceding 1902.

In the matter of live poultry Italy again has the balance of trade on her side. The imports have not been large, yet the amount for 1902 is very much larger than that for any previous year since 1885. The exports have been large all along, the average for the long series of years shown in the table being close to \$1,500,000.

The trade in dead poultry is not very great. The value of the imports in 1902 was \$7,961, while the exports for that year were valued at \$795,546. This latter amount has been exceeded but once, and that but slightly, in 1900.

Italian imports and exports of eggs, 1880 to 1903.

Year.	Imports.		Exports.	
	Quantity.	Value.	Quantity.	Value.
	<i>Kilograms.</i>	<i>Dollars.</i>	<i>Kilograms.</i>	<i>Dollars.</i>
1880.....	77,200	20,859	25,096,900	6,781,182
1881.....	175,100	43,933	21,830,900	5,477,374
1882.....	190,200	47,521	25,490,000	5,395,441
1883.....	175,700	40,088	23,716,700	5,949,520
1884.....	496,800	124,647	29,775,300	7,470,623
1885.....	411,300	108,191	28,874,400	7,234,587
1886.....	380,400	91,772	23,402,600	5,645,877
1887.....	240,500	68,021	19,376,900	4,674,677
1888.....	181,400	43,763	18,089,500	4,364,092
1889.....	162,700	40,821	14,155,400	3,571,590
1890.....	148,200	37,183	15,285,200	3,837,057
1891.....	128,800	32,316	17,507,700	4,392,682
1892.....	107,600	26,977	17,840,400	4,476,156
1893.....	91,300	22,897	23,652,400	5,934,387
1894.....	101,700	25,517	30,676,200	7,696,659
1895.....	122,100	33,655	24,679,200	6,191,011
1896.....	153,000	32,482	26,331,200	5,490,114
1897.....	248,800	52,820	29,399,000	6,283,368
1898.....	268,700	62,231	31,489,100	7,292,876
1899.....	216,100	54,219	33,797,700	8,479,843
1900.....	240,600	65,190	35,739,600	9,656,840
1901.....	381,900	106,875	33,048,200	9,248,539
1902.....	843,700	244,251	28,707,500	8,310,821
1903 ^a	1,355,100	392,291	25,505,100	7,413,725

^a Preliminary figures.

Italian imports and exports of live poultry, 1885 to 1903.

Year.	Imports.		Exports.	
	Quantity.	Value.	Quantity.	Value.
	<i>Kilograms.</i>	<i>Dollars.</i>	<i>Kilograms.</i>	<i>Dollars.</i>
1885.....	72,900	21,105	6,106,700	1,767,890
1886.....	75,500	19,590	5,932,800	1,602,989
1887.....	61,600	16,674	5,313,600	1,435,735
1888.....	75,700	18,993	4,875,000	1,223,041
1889.....	71,100	19,211	4,787,500	1,266,753
1890.....	73,400	19,883	4,767,500	1,288,179
1891.....	83,500	21,756	4,890,300	1,274,167
1892.....	127,200	33,142	4,909,200	1,279,092
1893.....	60,300	16,060	5,845,600	1,556,917
1894.....	67,300	17,924	6,970,300	1,856,470
1895.....	88,100	23,465	6,934,000	1,846,802
1896.....	80,800	21,052	6,676,200	1,739,494
1897.....	78,000	19,570	6,806,500	1,707,751
1898.....	53,600	12,931	6,618,300	1,796,665
1899.....	48,200	12,093	7,789,500	1,954,386
1900.....	68,300	17,136	6,688,900	1,678,245
1901.....	78,600	18,962	4,948,700	1,193,874
1902.....	150,400	37,735	5,363,900	1,345,808
1903 ^a	171,200	24,954	5,001,800	1,264,951

^a Preliminary figures.*Italian imports and exports of dead poultry, 1885 to 1903.*

Year.	Imports.		Exports.	
	Quantity.	Value.	Quantity.	Value.
	<i>Kilograms.</i>	<i>Dollars.</i>	<i>Kilograms.</i>	<i>Dollars.</i>
1885.....	9,400	2,266	1,872,200	649,502
1886.....	5,600	1,477	1,285,500	421,773
1887.....	7,900	2,592	1,137,900	373,345
1888.....	16,100	4,972	888,700	274,431
1889.....	15,100	4,954	933,900	306,413
1890.....	14,500	4,758	865,300	283,906
1891.....	12,300	3,598	1,018,400	284,482
1892.....	14,300	4,416	1,554,500	480,030
1893.....	14,700	4,539	1,607,700	496,457
1894.....	13,800	4,261	2,015,000	622,232
1895.....	19,400	5,991	2,092,000	646,010
1896.....	17,500	5,066	2,064,900	597,789
1897.....	12,500	3,378	1,626,800	493,561
1898.....	16,700	4,512	2,135,100	576,904
1899.....	38,600	10,302	2,569,000	718,935
1900.....	27,800	8,048	2,834,100	820,472
1901.....	23,500	6,576	2,551,700	714,093
1902.....	27,500	7,961	2,748,000	796,546
1903 ^a	41,000	11,869	2,453,400	710,259

^a Preliminary figures.

GERMANY.

The statistics for Germany are from Government official reports, and they are given for the "German customs district." This district comprises the 26 allied States and, in addition, the Grand Duchy of Luxembourg, the two Austrian communities of Jungholz and Mittelburg, bordering on the Bavarian territory, while separate parts of the German Empire (the territory of the free ports of Hamburg, Bremerhaven, and Geestemünde, the Prussian island of Heligoland, a part of the Hamburg community of Cuxhaven, and some of the rural communities of Baden on the Swiss borders) are excluded.

There are no data at hand to show what the German production of poultry and eggs is, but the table of exports and imports indicates very decidedly that this production is not sufficient to meet the needs of the German people. The imports of chickens in 1897 (the first year that they were reported separately) amounted to 7,468,800 kilograms, or 16,431,360 pounds, having a value of \$2,399,664. In the years following there was a steady increase, so that the amount of imports of chickens in 1903 was 10,609,800 kilograms, having a value of \$2,752,470. It will be observed that the increase in values has not kept pace with the quantities.

We find similar large imports of live geese and dead poultry. The imports of live geese into Germany in 1902 are nearly a half larger in quantity than the total number that were in the United States in 1900. The Russian statistics show a total export of live geese in 1902 amounting to 5,203,000 in number, and the German reports show that most of these are consumed in the latter country.

The imports of dead poultry are also very large, and, as will be noticed in the table, have gradually increased in both quantity and value. In 1897 the value of such imports was \$1,239,028 and in 1902 it was \$2,045,372.

The total value of imports of poultry—chickens, geese, other live poultry, and dead poultry—in 1903 was \$11,741,492. When we add to this sum the value of the imports of eggs, egg yolks, and egg whites, we have a grand sum of \$38,680,950.

German imports and exports of live and dead poultry, 1895 to 1903.

IMPORTS.

Year.	Live chickens.		Live geese.		Other live poultry.		Dead poultry.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Kilograms.	Dollars.	Kilograms.	Dollars.	Kilograms.	Dollars.	Kilograms.	Dollars.
1895.....	25,448,900	4,457,740					2,858,400	877,506
1896.....	24,502,700	4,041,240					3,364,800	1,041,012
1897.....	7,468,800	2,399,664	18,073,800	2,494,954	2,114,500	709,002	4,067,200	1,239,028
1898.....	8,363,500	2,279,084	20,311,600	4,176,662	2,251,600	754,222	4,119,100	1,225,462
	Number.		Number.		Number.		Number.	
1899.....	8,925,600	2,421,650	6,875,810	4,254,726	2,435,700	817,054	4,482,500	1,333,514
1900.....	9,615,500	2,608,950	6,220,055	4,219,264	2,438,900	818,720	5,158,500	1,583,652
1901.....	9,373,500	2,498,524	6,431,247	4,301,132	2,268,300	758,744	6,601,400	2,042,516
1902.....	10,594,600	2,746,282	7,254,145	5,568,724	2,669,400	894,404	6,714,100	2,050,370
1903.....	10,609,800	2,752,470	7,814,723	6,007,596	2,876,200	965,090	6,618,500	2,016,336

EXPORTS.

Year.	Live chickens.		Live geese.		Other live poultry.		Dead poultry.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Kilograms.	Dollars.	Kilograms.	Dollars.	Kilograms.	Dollars.	Kilograms.	Dollars.
1895.....	272,600	14,288					133,500	59,976
1896.....	279,100	88,298					179,800	77,112
1897.....	111,900	53,312	97,500	20,944	54,100	25,704	227,800	101,864
1898.....	168,500	80,206	102,200	36,414	38,300	18,326	115,000	68,544
	Number.		Number.		Number.		Number.	
1899.....	169,200	79,844	50,605	90,440	47,600	22,610	285,600	125,188
1900.....	191,400	91,154	53,309	63,546	46,300	22,134	264,700	115,906
1901.....	135,300	64,498	55,373	65,926	53,000	25,228	285,900	123,046
1902.....	131,200	58,256	55,329	72,352	52,600	24,990	272,600	117,384
1903.....	75,700	36,938	99,444	130,186	49,700	23,122	307,700	132,566

For the years of 1895 and 1896 game and geese are included under the head of "Chickens." After 1896 chickens only are given, while geese are given under a separate head.

German imports and exports of eggs and egg whites, 1895 to 1903.

Year.	Imports.				Exports.			
	Eggs (including yolks).		Egg whites.		Eggs (including yolks).		Egg whites.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Kilograms.	Dollars.	Kilos.	Dollars.	Kilograms.	Dollars.	Kilograms.	Dollars.
1895.....	83,565,000	17,104,108	196,800	187,316	771,900	176,358	208,400	170,888
1896.....	89,029,800	18,858,406	171,000	162,792	745,300	175,644	136,100	80,920
1897.....	99,590,200	20,384,224	213,300	213,248	694,100	158,508	107,000	69,144
1898.....	105,835,800	17,002,482	261,000	298,214	544,800	110,194	117,500	67,016
1899.....	112,578,600	21,568,988	243,900	276,698	497,500	107,100	208,200	119,000
1900.....	118,169,700	24,051,090	235,600	246,805	613,100	140,082	263,500	37,604
1901.....	116,486,500	24,202,934	270,000	224,910	698,800	162,078	289,400	55,216
1902.....	128,153,800	27,386,898	506,700	241,094	506,700	230,622	379,000	90,202
1903.....	124,776,900	26,667,900	1,140,700	271,558	1,035,500	245,568	416,600	106,386

AUSTRIA-HUNGARY.

In discussing the trade of Austria-Hungary it is necessary to explain that the officials of that Government use such terms as "special trade" and "transit trade." The special trade includes the imports for consumption and the exports of domestic production. The transit trade, as the phrase suggests, is that which passes through the country, going principally from Russia, Italy, Roumania, and Servia to Germany, Great Britain, Belgium, and Switzerland. The general trade includes both the special trade and the transit trade. The accompanying table shows a large business in the handling of eggs, and by inference a very large production. The same terms with the same meanings are used in Italy. In every year shown the exports have exceeded the imports, and in 1902 this difference was that between 49,514,100 and 120,324,700 kilograms, or 70,810,600 kilograms. It does not appear from the information at hand why there should be any imports whatever when so many eggs are exported; but the records show that most of the imported eggs are from Russia, and we learn, in studying the egg market of England, that the Russian eggs are quite small as compared with those from other countries. So the explanation probably lies in this, that the larger eggs of domestic production are exported from Austria-Hungary and the smaller and cheaper Russian eggs are imported for consumption.

Austro-Hungarian imports and exports of eggs, 1880 to 1903.

Year.	Special trade.				Transit.
	Imports.		Exports.		
	Quantity.	Value.	Quantity.	Value.	
	Kilograms. ^a	Dollars.	Kilograms.	Dollars.	Kilograms.
1880.....	2,480,100	181,246	27,262,800	2,213,739	
1881.....	2,975,000	217,413	29,662,800	2,408,619	
1882.....	3,287,000	240,214	24,540,700	1,992,705	
1883.....	1,080,000	75,272	33,884,100	2,751,889	
1884.....	951,200	88,823	27,577,200	2,575,159	
1885.....	1,043,100	97,404	38,025,200	3,450,793	
1886.....	693,700	70,412	45,372,700	4,605,329	
1887.....	459,500	42,840	45,504,200	4,248,483	
1888.....	451,900	42,549	48,335,500	4,907,821	
1889.....	612,700	60,538	55,757,100	5,889,170	
1890.....	613,100	60,571	60,995,800	6,566,199	
1891.....	802,000	81,403	55,880,100	6,465,952	24,219,600
1892.....	830,000	91,504	65,249,800	9,501,085	25,384,000
1893.....	1,781,500	178,247	66,299,900	9,560,084	22,241,200
1894.....	20,707,100	2,942,489	90,207,400	15,375,166	19,675,300
1895.....	40,360,400	5,407,486	91,527,500	15,978,871	8,838,100
1896.....	37,220,100	5,289,046	88,670,700	16,200,187	12,753,500
1897.....	37,108,500	5,423,778	94,453,400	16,831,857	12,164,000
1898.....	40,454,500	5,746,226	95,796,100	16,289,291	15,392,400
1899.....	42,309,500	5,550,883	104,047,500	17,299,192	19,596,400
1900.....	39,349,400	5,563,155	108,787,500	20,150,285	18,015,900
1901.....	42,078,500	5,972,505	106,885,500	19,597,676	21,457,500
1902.....	49,514,100	7,046,704	120,324,700	22,764,181	31,076,900
1903 ^b	52,377,800	7,559,923	112,611,500	21,746,375	

^aThe French officials estimate that 20 eggs of average size are equal to 1 kilogram.
^bPreliminary figures.

Previous to 1898 the values were given in gulden, worth 40.6 cents, but since 1898 and including that year they are stated in kronen, worth 20.3 cents.

The next table shows the imports of live and dead poultry and the exports of all kinds of poultry. The imports are comparatively small, but the exports are enormous for so small a country, showing a gradual increase for the years shown in the tabular statement.

Austro-Hungarian imports and exports of poultry, all kinds, 1891 to 1903.

Year.	Imports.				Exports.	
	Live poultry.		Dead poultry.		Quantity.	Value.
	Quantity.	Value.	Quantity.	Value.		
	<i>Kilograms.</i>	<i>Dollars.</i>	<i>Kilograms.</i>	<i>Dollars.</i>	<i>Kilograms.</i>	<i>Dollars.</i>
1891.....	1,409,800	286,236	74,000	15,022	6,520,400	1,588,272
1892.....	1,750,500	452,690	69,500	15,022	7,001,500	2,059,232
1893.....	1,667,000	378,798	74,000	15,834	7,428,000	2,272,788
1894.....	2,037,100	496,132	90,900	18,270	8,481,500	2,582,566
1895.....	2,891,100	704,410	100,200	14,210	7,778,900	2,524,914
1896.....	3,300,500	808,890	90,400	14,616	7,626,500	2,415,294
1897.....	3,802,700	926,492	107,100	19,488	9,024,700	2,748,214
1898.....	4,631,200	1,128,274	99,000	16,849	9,708,700	2,838,840
1899.....	5,423,900	1,140,860	95,000	15,428	10,881,200	3,975,968
1900.....	6,325,400	1,323,154	96,300	15,225	13,338,100	4,341,561
1901.....	7,281,000	1,345,484	90,400	18,270	10,013,900	2,032,842
1902.....	6,813,800	1,344,063	86,400	17,468	12,222,300	2,481,127
1903 ^a	5,597,100	1,022,511	.....	.....	.....	3,233,374

^a Preliminary figures.

The information given herewith concerning poultry raising in Hungary is from an article by G. Parthay, in *Ungarns Landwirthschaft*, 1896. He first states that Hungary has the necessary conditions for poultry raising, and that the profits of the industry may be increased greatly by a more thorough knowledge of the subject. The breeds of poultry now in use are second or third class. Excepting the turkeys, which were imported from America, all breeds have been known there for ages.

It is hardly possible that the Hungarians brought poultry with them from Asia, but they no doubt acquired some soon after. The produce of poultry was an article of trade in 1300. An order of the King in 1498 prohibited the export of poultry. In 1514 an order of the King required bondmen to pay their landlords 12 chickens and 2 geese annually. From that time till 1850 there was no progress in poultry raising. After this latter date some improvement was noticed.

It was estimated in the early sixties by Baron Cjörning that there were about 30,000,000 fowls in the country and that they were worth \$12,060,000. The exports at that time amounted to \$40,000 or \$50,000, and rose to \$400,000 in the "seventies." About this latter date the Bistrizer society of Saxon farmers organized and arranged for a

poultry fair. This, so far as known, is the first poultry show held, but its action was soon imitated by other agricultural societies. A national poultry show was held at Budapest in 1874, but as yet no really important improvement had been made. In 1877 a society of practical poultry raisers was formed, and its influence for progress was felt at once, and improvements were rapid thereafter. Numbers were multiplied, and the census for 1884 gave the following statistics of poultry on the peasant farms and on large estates:

On peasant farms:	Number.
Chickens	18, 937, 043
Turkeys	444, 225
Geese	4, 854, 049
Ducks	2, 155, 672
Doves	1, 768, 182
On large estates:	
Chickens	2, 744, 145
Turkeys	238, 998
Geese	776, 830
Ducks	519, 098
Doves	478, 426
Total	32, 916, 668

This census was taken in September, after the principal sales for the summer had been made.

In 1890 courses of instruction in poultry raising were given for the first time, and in 1891 a course in poultry breeding was given in the preparatory schools. In 1892 a market was established in the Tiergarten at Budapest, and eggs of purebred fowls were distributed free of charge to breeders. In 1893 the agricultural department distributed poultry among 16 associations and 79 teachers in the public schools. In 1894 this department gave 33 free courses of instruction on poultry breeding by means of traveling teachers, and 500 fowls were distributed. All this has tended toward a general interest in the matter of poultry raising.

In recent years, and especially since 1890, the Government has shown greater interest in this industry by organizing fairs, spreading information, and introducing better breeds.^a It has ascertained what foreign breeds would best acclimate in the country and from its breeding stations has exchanged cocks and eggs of these for an equal number of those of the common kind, thus placing excellent birds within easy reach of the peasants. The Government recommended the Plymouth Rock and Langshan chickens, the French and bronze-colored turkeys, the Pekin ducks, and the Embden geese as being best adapted to the country.

^aDie Landwirtschaft Ungarns, by Dr. Alexander V. Matlekovits. Leipzig, 1900, pp. 276 ff.

According to the agricultural enumeration of 1895 there is a slight decrease since 1884 in the number of poultry, while the exports have trebled in the same period. It is difficult to find a satisfactory explanation of this.

NETHERLANDS.

The table below, which gives the imports and exports of eggs in the trade of Netherlands for the period of 1880 to 1901, shows that the general trend has been upward for the imports and also for the exports. The exports at no time have been so large as the imports.

Prussia up to the year 1895 furnished very much more than half of the total imports of eggs, but in 1896 Russia nearly equaled the Prussian supply, increasing her supply from 911,686 kilograms in 1895 to 2,001,861 kilograms in 1896. The Russian supply exceeded the Prussian supply after this date, except for the one year of 1900. Most of the so-called Prussian eggs, however, come from Russia and Austria-Hungary, and are termed Prussian in the reports because custom-house officials are in the habit of crediting merchandise to the country last touched without inquiring into its origin.

Imports and exports for Netherlands of eggs, 1880 to 1902.

Year.	Imports.		Exports.	
	Quantity.	Value.	Quantity.	Value.
	<i>Kilograms.^a</i>	<i>Dollars.</i>	<i>Kilograms.</i>	<i>Dollars.</i>
1880.....	4,179,445	736,062	284,034	51,382
1881.....	5,210,220	942,529	562,527	101,761
1882.....	6,567,039	1,985,977	361,852	65,459
1883.....	4,988,352	902,393	281,308	50,888
1884.....	4,137,653	738,501	248,315	44,920
1885.....	4,154,174	751,490	434,223	78,551
1886.....	3,912,185	707,714	344,739	62,363
1887.....	4,093,119	740,445	346,979	62,769
1888.....	4,555,618	824,111	574,268	104,285
1889.....	4,579,206	828,378	551,485	99,764
1890.....	4,191,497	758,242	491,017	88,825
1891.....	5,095,755	921,822	495,113	99,566
1892.....	4,540,637	821,398	467,957	84,654
1893.....	4,286,822	773,822	489,836	88,612
1894.....	4,244,753	767,876	677,217	122,508
1895.....	4,488,635	811,994	1,127,543	208,972
1896.....	5,019,372	908,004	1,969,659	359,929
1897.....	6,075,279	1,099,018	2,533,657	458,338
1898.....	7,156,428	1,294,598	4,240,159	767,044
1899.....	6,196,034	1,120,862	3,687,548	677,078
1900.....	5,941,414	1,074,802	3,623,392	655,470
1901.....	5,827,788	1,054,247	3,747,915	677,470
1902.....	5,284,003	955,876	3,803,533	688,069

^aThe French officials estimate that 20 eggs of average size are equal to 1 kilogram.

BELGIUM.

The statistics of Belgium are full of interest as showing the import and export trade for a long series of years.

Value of the imports and exports for Belgium of eggs, 1831 to 1900.

Year.	Imports.	Exports.	Year.	Imports.	Exports.
1831	\$579	\$55,970	1866	\$110,782	\$346,821
1832	772	61,567	1867	105,764	339,680
1833	772	66,585	1868	106,764	339,873
1834	2,895	41,495	1869	165,980	409,925
1835	3,068	35,898	1870	212,107	359,559
1836	965	31,073	1871	170,567	430,390
1837	1,980	29,529	1872	318,257	429,460
1838	2,316	33,647	1873	541,944	382,333
1839	3,744	40,916	1874	318,127	477,492
1840	5,397	40,337	1875	815,232	466,288
1841	6,562	47,864	1876	1,612,129	987,195
1842	8,878	40,530	1877	1,253,728	1,103,381
1843	9,071	29,722	1878	2,157,870	937,787
1844	8,492	37,635	1879	1,444,219	987,388
1845	9,071	47,771	1880	1,394,039	816,969
1846	10,036	42,460	1881	1,373,295	1,740,667
1847	7,141	61,567	1882	1,356,973	1,839,097
1848	7,527	62,339	1883	1,672,924	1,003,600
1849	10,422	86,078	1884	1,757,844	1,187,529
1850	11,773	125,585	1885	1,556,352	2,951,163
1851	12,352	138,574	1886	1,567,932	1,075,589
1852	10,422	164,050	1887	1,495,943	249,935
1853	8,878	241,443	1888	1,226,647	924,506
1854	9,071	288,728	1889	1,213,391	869,272
1855	8,299	445,058	1890	1,570,634	834,532
1856	8,299	137,609	1891	1,589,355	1,028,883
1857	9,650	125,257	1892	1,353,895	916,567
1858	11,001	119,467	1893	1,398,759	824,689
1859	15,613	129,696	1894	1,476,643	1,053,008
1860	17,563	191,842	1895	2,042,519	1,489,767
1861	22,581	229,670	1896	2,242,467	1,746,763
1862	28,757	242,601	1897	2,319,474	2,065,486
1863	33,196	261,901	1898	1,971,688	1,819,183
1864	55,970	316,906	1899	1,891,207	1,759,967
1865	78,944	266,147	1900	1,962,424	1,505,979

RUSSIA.

The exports of Russian eggs have been increasing greatly during recent years, and the possibility of that country for expansion in the production of poultry and eggs seems to be unlimited. The information upon production, consumption, methods of shipment, etc., is very meager. Some tables are given of exports of poultry and poultry products over the European frontiers, but nothing is available on the conditions in Asiatic Russia.

The first table gives the quantity and value of the exports of eggs for a series of years, showing an increase in value from \$5,226,772 in 1888 to \$17,917,880 in 1901. A study of these figures, however, in connection with similar statistics from other exporting European countries, shows that the Russian eggs are considered an inferior article and usually rank last in the market quotations. The eggs are not produced and prepared for shipment with that scrupulous care that characterizes the work of Denmark, France, and Ireland.

The second table shows that a business of no mean importance is done in the matter of exporting egg yolks and egg whites. The business in 1902 amounted to more than \$90,000.

Russia is one of the leading geese-raising countries, and most of the exports of this product, both alive and dead, go to Germany. The table shows figures of exports of geese and other live poultry combined for several years, but since 1899 the geese have been given separately. The number exported in 1900 was 5,302,832. That is only 300,000 less than the number of geese in the United States in the same year. But it should be pointed out in this connection that a very large number of geese are slaughtered before shipment, and these form a considerable part of the exports shown in the table of "Exports of dead poultry and game." It is not possible to show how much of the quantities given in the table is geese or how much is game, but it is quite certain that considerably more than half of the total is geese.

Russian exports of eggs by European frontiers, 1888 to 1903.

Year.	Dozens.	Value.	Year.	Dozens.	Value.
1888.....	56,518,065	\$5,226,772	1896.....	122,312,592	\$11,270,366
1889.....	50,437,036	5,058,204	1897.....	141,894,054	13,047,793
1890.....	62,545,728	6,889,555	1898.....	157,015,917	15,887,438
1891.....	69,090,458	6,733,640	1899.....	138,607,250	14,553,704
1892.....	60,929,131	5,888,000	1900.....	145,234,084	15,835,214
1893.....	64,926,359	6,779,287	1901.....	162,250,000	17,917,880
1894.....	78,924,062	8,059,422	1902.....	185,750,000	19,886,725
1895.....	116,767,903	10,249,848	1903.....	230,666,666	26,265,000

^a These figures are preliminary and, in addition to the exports by the European frontier, include those to Finland and from the Caucasus.

Russian exports of egg yolks and egg whites by European frontiers, 1888 to 1902.

Year.	Egg yolks.		Egg whites.		Year.	Egg yolks.		Egg whites.	
	Quantity.	Value.	Quantity.	Value.		Quantity.	Value.	Quantity.	Value.
	Pounds.	Dollars.	Pounds.	Dollars.		Pounds.	Dollars.	Pounds.	Dollars.
1888.....	2,333,586	156,911	324,150	25,838	1896.....	2,428,094	149,889	422,847	20,258
1889.....	2,779,690	168,354	378,825	26,524	1897.....	2,831,698	201,351	432,959	20,118
1890.....	2,724,004	171,084	428,156	31,429	1898.....	2,307,043	157,656	406,091	18,244
1891.....	2,000,480	115,844	325,811	20,390	1899.....	1,306,749	84,305	177,206	10,948
1892.....	1,136,946	65,360	269,259	15,047	1900.....	1,648,739	106,997	221,012	12,700
1893.....	2,214,449	141,992	345,349	14,858	1901.....	1,256,227	73,051	94,905	5,000
1894.....	2,325,063	177,743	353,655	22,181	1902.....	1,336,181	80,855	144,452	10,300
1895.....	3,200,117	284,514	492,040	28,536					

Russian exports of geese and other poultry, 1888 to 1902.

Year.	Geese and other poultry.		Year.	Geese and other poultry.	
	Quantity.	Value.		Quantity.	Value.
	Number.	Dollars.		Number.	Dollars.
1888.....	2,759,533	1,240,402	1894.....	5,050,414	2,582,524
1889.....	3,731,066	1,845,000	1895.....	6,028,003	2,587,735
1890.....	3,819,657	2,014,807	1896.....	5,406,725	2,409,000
1891.....	4,424,178	2,090,867	1897.....	6,215,067	2,562,120
1892.....	4,834,413	2,536,623	1898.....	7,562,709	3,270,154
1893.....	4,507,447	2,285,964			

Year.	Geese.		Other poultry.	
	Quantity.	Value.	Quantity.	Value.
	Number.	Dollars.	Number.	Dollars.
1899.....	4,999,488	2,504,676	2,547,323	769,354
1900.....	5,302,832	2,662,239	2,778,154	690,277
1901.....	5,650,715	2,865,981	2,501,811	602,803
1902 ^a	5,203,000	2,642,465	3,180,000	777,650

^a These figures are preliminary and, in addition to the exports by the European frontiers, include those to Finland and from the Caucasus.

Russian exports of dead poultry and game, 1888 to 1902.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Number.	Dollars.		Number.	Dollars.
1888.....	2,371,940	471,540	1896.....	2,271,476	876,704
1889.....	2,898,378	704,278	1897.....	2,689,984	1,064,386
1890.....	1,927,486	516,229	1898.....	2,340,968	749,856
1891.....	1,689,250	390,025	1899.....	2,736,192	791,335
1892.....	1,316,553	287,527	1900.....	3,135,502	1,065,135
1893.....	1,157,517	411,345	1901.....	3,16,913,018	1,431,914
1894.....	935,565	245,594	1902 ^b	3,13,361,810	997,040
1895.....	1,433,521	495,116			

^a Pounds.

^b These figures are preliminary and, in addition to the exports by the European frontiers, include those to Finland and from the Caucasus, and for 1902 are for poultry only.

APPENDIX I.—RULES GOVERNING THE SOCIETY FOR POULTRY BREEDING IN DENMARK.

[Translation by Andrew Fossum, Ph. D.]

A. OBJECT.

SECTION 1. The society, which has its headquarters at Aarhus, has for its object the promotion of poultry keeping in Denmark.

B. MEMBERS.

SEC. 2. (a) Honorary members; (b) extraordinary members, who pay at least 50 kroner (\$12.40) once for all, or 10 kroner (\$2.68) annually; and (c) ordinary members, who pay 2 kroner (53.6 cents) a year, in foreign lands 4 kroner (\$1.07) a year. Members are classified into county circuits. Application for membership is made either to the directors or representatives of the society or to the office of the society at Aarhus. Resignations must be sent in writing to the head office. A member will be obliged to pay the fee for the current year, unless he sends in his resignation before the first of January. In case a member refuses to pay the fee when it is due his name is struck from the membership list. By a unanimous vote directors may strike the names of members from the list. An excluded member may appeal to the representatives. The annual fee is due in January and is collected in February through the mails. Twenty-five per cent of the fees from members goes to the county circuit. Apportionments are made on April 1 and December 31 of each year. Honorary members are admitted by a two-thirds vote of the representatives present at a meeting, on the recommendation of the directors.

C. DIRECTORATE.

SEC. 3. The directorate consists of seven members, of whom, as a rule, there are three from Jutland, one from Fyn, two from Sjælland and Bornholm, and one from Lolland-Falster. These choose from their own number a president and a vice-president for one year. The president, vice-president, and secretary are the executive committee. The directors define the authority of the executive committee. Of the directors, two retire the first two years by lots, and three the third year in the same manner, and so on by turns.

SEC. 4.—The president, or in his absence the vice-president, represents the society and summons the executive committee and directorate to meetings, which must also be held when more than one-half of either make such a demand. Meetings are called at least one week in advance by letter, in which is contained also the order of the day. The meetings may act when more than one-half of their members are present. The president presides at all the meetings, also at those of the representatives, and orders the payment of bills against the society.

SEC. 5. The secretary, who is also treasurer, is chosen by the directorate. In case of a change of secretary the salary and office expenses are decided on by the representatives on the recommendation of the directorate. The secretary is to keep a membership list, conduct the correspondence, keep the minutes of the meetings, edit the reports, receive the annual fees and charges for advertisements, and present the financial statement for the year, which is to go to the auditors at the latest in the January quarter.

SEC. 6. The society appoints an adviser, who is nominated by the directors, but whose salary is determined by the representatives on the recommendation of the directors. The directors instruct him as to his duties.

D. COMMITTEES.

SEC. 7. The following standing committees are appointed: (1) The periodical, library, lectures, prize competitions, adviser, etc. (2) Distribution of breeds, breed-

ing centers, feeding of young chickens, trade in the products of poultry, breeding, awarding of prizes to well-conducted and profitable poultry runs, etc. (3) Poultry shows. The committees consist of three members each, of whom the directors elect one. The committees choose their own chairmen and distribute the work among themselves. The committees meet as often as the chairmen find it necessary.

SEC. 8. Besides traveling expenses over the shortest route by first-class steamer and second-class railway, directors and members of committees receive an allowance of 6 kroner (\$1.61) per day while in the service of the society.

E. AUDITING.

SEC. 9. The representatives elect annually two auditors to revise the current expenses of the year. The financial year is the same as the calendar year. The auditors must complete their work at the latest one month after receiving the financial statement.

SEC. 10. The financial statement, with any notes concerning it, is returned to the president, who allows the secretary an opportunity to express himself regarding these before he presents it to the representatives for adoption.

F. REPRESENTATIVES.

SEC. 11. The representative body is the supreme authority in the society. It is composed of the presidents and vice-presidents of the county circuits, with the secretaries as substitutes (Copenhagen is considered one county), and consists of twelve members from Sjælland, two from Bornholm, four from Fyn, two from Lolland-Falster, and twenty from Jutland; total, forty.

SEC. 12. As a rule the society holds one meeting a year. The call is to appear in the Periodical for Poultry Breeding at least two weeks before the meeting. The meeting is legal if it has been summoned in due form and more than one-half of its members are present. Extraordinary meetings of the representatives may be summoned by the president, who is required to do so when more than one-half of the presidents of the county circuits demand it.

SEC. 13. The meeting is held in the early summer, usually in connection with the annual exhibition.

SEC. 14. Every member of the society is admitted to the meeting of the society. Only members of the directorate, representatives, and honorary members are entitled to take part in the discussions and vote at the meeting.

SEC. 15. The directors shall present at the regular meetings of the representatives (a) the audited financial statement of the last year for adoption; (b) the plan of work for the society in the coming year; (c) the budget; (d) the election of two auditors for the current year in accordance with section 9; (e) the election of directors in accordance with section 3; (f) the election of committees according to section 7, and (g) the election of judges for the next exhibition.

SEC. 16. Any representative may make inquiries of the directorate and send in, either from himself or from other members, subjects for discussion at the meeting. These must, however, reach the directorate four weeks before the meeting of the representatives. Subjects arriving later should be reported to the meeting, but can not, without the consent of the directorate, be discussed or voted upon. So far as possible, the directors should print and forward to the representatives before the meeting the subjects for discussion. The directorate determines the order in which the subjects for discussion are to be taken up.

SEC. 17. The representatives can by a majority vote pass resolutions in any matter pertaining to the society. Voting is done by show of hands or, if five of the members of the meeting so desire, by ballot.

SEC. 18. The representatives traveling by first-class steamer or second-class railway over the shortest route to and from the meetings have their expenses paid. Their board is also paid by the county circuit in accordance with the decisions of the circuit as to details.

G. PERIODICAL.

SEC. 19. The head and county circuits have a common organ, which is sent free to all members. It appears at least twice a month. The directors choose the editor and the representatives determine his salary in accordance with the recommendation of the directors.

H. CHANGE OF RULES.

SEC. 20. In case of doubt as to the correct interpretation or application of the rules the directors decide, subject to appeal to the representatives.

SEC. 21. Only a meeting duly summoned and attended by the representatives of more than one-half of the counties can by a two-thirds majority vote make changes in or additions to these rules. In case a meeting can not legally act, a new meeting is called, which may decide the matter by a simple majority vote.

Thus adopted at the meeting of the representatives at Slagelse in 1902.

**By-Laws of the Society for Poultry Breeding in Denmark—Circuit Society
in ——— County.**

A. THE OBJECT OF THE CIRCUIT.

SECTION 1. The object of the circuit is to work for the promotion of poultry breeding in ——— county, and this is sought by exhibitions, pamphlets, meetings, lectures, and in any other way that the directors find suited to their purpose. The circuit is a section of the Society for Poultry Breeding in Denmark.

B. MEMBERS OF THE SOCIETY.

SEC. 2. On application to the directors of the circuit, anyone may become a member of the circuit and thereby of the Society for Poultry Breeding in Denmark. Members may be excluded by the unanimous vote of the directorate; yet an excluded member may appeal to the first general meeting.

SEC. 3. The means of the circuit are as follows: Twenty-five per cent of the fees of the members of the Society for Poultry Breeding in ——— County; honorary prizes from the Society for Poultry Breeding in Denmark to the exhibition of the circuit; gifts received on application from savings banks, etc., in the county; State subsidies for the annual exhibition, obtained chiefly through local agricultural societies; other contributions from persons interested in the work.

SEC. 4. Every new member receives, on paying his initiation fee, a copy of the rules of the Society for Poultry Breeding in Denmark and by-laws of the circuit.

C. THE DIRECTORATE.

SEC. 5. The directorate consists of at least three members, chosen from the total number of members of the circuit. Of their own number they choose, for one year at a time, a president, vice-president, and secretary and treasurer. The president and vice-president, with the secretary as a substitute, are representatives in the Society for Poultry Breeding in Denmark.

SEC. 6. The president summons the directors to meetings one week in advance; and meetings must be held when more than one-half of the directors demand it in writing. In order that the resolutions of the directors may be valid, more than one-half of the directors must be present. The president presides and directs the discussions in the meetings of the directors and in the general meetings. He looks after the general interests of the circuit and decides current matters which he does not deem sufficiently important to lay before the directors as a body. In the absence of the president the vice-president takes his place.

SEC. 7. The secretary of the circuit, who is also treasurer, conducts the correspondence of the society, keeps the minutes of all the meetings, arranges shows and exhibitions, provides office room, and keeps the archives of the society, and, under the direction of the president, transacts all the business of the society; keeps a correct list of the members of the society, which list is always to be on hand at the meetings. He makes up the accounts of the year, which must be sent to the auditors at the latest one month after the close of the financial year. The auditors return the audited accounts to the president, who allows the secretary an opportunity to express himself regarding the report of the auditors, and submits the accounts to the directorate and to the general meeting.

D. THE GENERAL MEETINGS AND THE MEETINGS FOR DISCUSSION.

SEC. 8. The circuit holds an annual general meeting in the spring, usually in the month of March. The announcement appears at least two weeks in advance in the Poultry Journal, which is the paper of the society and which is sent free to all members. The other meetings of the circuit are announced in the same way. The president may call extraordinary meetings, and is obliged to do so when more than one-half of the directorate or twenty of the members of the society request it in writing.

SEC. 9. A plan for the activity of the circuit in the following year is submitted to the general meeting with the necessary information as to the financial condition of the society. There is to be submitted to the general meeting, furthermore, (a) the audited accounts of the last financial year for adoption; (b) in case an exhibition and prizes are proposed, a program worked out in detail as to divisions into classes and size of prizes; (c) a committee of judges for the exhibition is elected; (d) two auditors of the accounts of the current year are chosen; (e) directors for the following year are chosen. The choice is for two years, but the first year one more than one-half withdraws; the second year the remainder withdraws; the first time by lots, later by turns.

SEC. 10. The president receives, by March 1, any proposition that a member may desire to have discussed by the meeting.

SEC. 11. The general meeting may, when it is legally summoned, pass resolutions in any affair of the society. Propositions to change the rules must formerly have been discussed, and, in calling the meeting, the announcement must be made that a vote will be taken to change the rules and that changes are made by a two-thirds majority of the members present. In order to be valid, the resolution must be ratified by the representatives of the Society for Poultry Breeding in Denmark.

SEC. 12. Members vote by show of hands, or by ballot when two of the members so desire. Members present may, when so empowered, vote by proxy, but no one shall cast more than five votes.

E. EXHIBITION.

SEC. 13. In case the circuit decides to hold an exhibition and award prizes, it selects, in order to pass upon the exhibits, not less than three judges, of whom the circuit chooses two and a substitute and the Society for Poultry Breeding in Denmark the third and a substitute.

SEC. 14. The judges are required, unless they judge by points, to give reasons for their decisions. The memoranda of the judges are entered on the minutes of the society.

SEC. 15. The president and vice-president of the society, or, in their failure to go, the secretary, have their expenses to the meetings of the representatives of the Society for Poultry Breeding in Denmark paid in proportion to the length of the journey, according to the detailed resolutions of the circuit.

Thus adopted at the meeting of representatives at Slagelse, 1902.

**APPENDIX II.—RULES OF THE SOCIETY FOR THE PROMOTION OF
POULTRY BREEDING IN DENMARK.**

[Translation by Andrew Fossum, Ph. D.]

A. OBJECT.

SECTION 1. The object of the society is to further poultry breeding, especially chicken breeding, and the egg trade in Denmark.

SEC. 2. The society strives to attain this by (a) the distribution of pamphlets; (b) by holding exhibitions, discussions, and lectures; (c) by directions and information regarding poultry matters; (d) by establishing experiment stations and distributing poultry and selling eggs of pure breeds.

B. MEMBERS.

SEC. 3. The members are (a) honorary members, who may be chosen at the meetings of the representatives on the recommendation of the directorate; (b) extraordinary members—any member who has paid into the treasury at one time not less than 50 kroner (\$13.40) may become an extraordinary member; (c) ordinary members, who pay an annual fee of (1) 2 kroner (53.6 cents) in case they live in Denmark, (2) 3 kroner (80.4 cents) in case they live abroad. The directors may, when the circumstances require it, increase or decrease the fee and accept poor members free of charge. The fee for the current year is collected in January in advance. Application for admission goes to the office of the society. Withdrawal is sent in writing to the same office, and must be in before the first of December; otherwise a member is obliged to pay the fee for the following year. In case a member refuses to pay the fee when it is due his name is dropped from the membership list. Members may be excluded by a two-thirds vote of the representatives present on the unanimous recommendation of the directors.

C. DIRECTORATE.

SEC. 4. The directorate consists of nine members chosen by the representatives from their own members at their meeting. Three withdraw annually by turns. The directorate chooses its own president and vice-president. In years when the society gives exhibitions the directorate may add to their number; the directorate thus increased constitute the exhibition committee.

SEC. 5. The president represents the society and calls the meetings of the directorate. Meetings must also be held when more than one-half of the directors so desire. Resolutions are binding if more than one-half of the directors are present. The president or vice-president presides at the meetings of the directorate.

SEC. 6. The directorate appoint a business manager, fix his salary, and instruct him regarding his course of action. The manager acts as secretary and treasurer, and is present at all the meetings; he also gives security in the amount of at least 2,000 kroner (\$536). He can not vote unless he is a member of the directorate.

SEC. 7. The manager is required to have an office at Copenhagen. He keeps a list of the members, the minutes of the meetings of the directors and representatives, conducts the correspondence, preserves and arranges the archives, edits the reports of the meetings of the representatives, receives the fees of the members, and submits the annual accounts. These he sends in the January quarter to the president, who forwards them to the auditors. Bills can be paid only when they are approved by the president or vice-president.

SEC. 8. Matters to be decided by the representatives and requiring expedition may in exceptional cases be decided by the directorate without a meeting by letting the representatives vote by letter, the directors mailing voting blanks to the representatives.

D. REPRESENTATIVES.

SEC. 9. The directorate are elected and assisted by a body of representatives consisting of thirty members—fifteen from Copenhagen and fifteen from the rest of the country. One-third withdraw annually by turns. Representatives and substitutes are chosen by the ordinary members of the society by majority vote. The election takes place at the meeting of the representatives and must be announced two weeks in advance in the Poultry Journal. No one can vote by proxy. If any meeting does not have at least one hundred voting members present—not counting representatives and directors—the election goes to the meeting of representatives and directors. Directors and representatives have the right to vote as ordinary members. Admission to the meetings of the representatives is open to all members, but only directors and representatives, except in accordance with the rules above, have the right to vote. Directors have no vote in electing directors. The representatives supervise the actions of the directors through auditors chosen by the representatives.

SEC. 10. The society holds annual meetings of the representatives at Copenhagen. In exhibition years the representatives hold their meeting during the exhibition. Notice of the meeting appears in the paper of the society four weeks in advance. The representatives are furnished with the order of the day and an abstract of the accounts at least two weeks before the meeting. When a member can not be present, he shall notify the directors at least five days in advance. The directorate may summon a substitute to take the place of such a member. The president shall call extra meetings of the representatives when more than one-half of the directors and representatives demand them.

SEC. 11. Members have free admission to all the exhibitions of the society.

SEC. 12. The directors shall present at the annual meetings of the representatives (a) the audited accounts of the previous year for adoption; (b) the plan of work for the coming year; (c) the plan of the exhibition in case one is to occur in the coming year; (d) nominations of judges for the exhibition; (e) two auditors and two substitutes for the next financial year; (f) choice of directors; (g) choice of representatives and substitutes; (h) selection of the next meeting place. The directors and representatives together choose a chairman, who can not speak, however, without the consent of the meeting.

SEC. 13. Any representative may make inquiries of the directorate and send in subjects for discussion at the meetings of the representatives. These he must send at least four weeks in advance. Subjects arriving later may be reported to the meeting, but can not be discussed. So far as possible, the directors are to print and forward to the representatives before the meeting the subjects for discussion.

SEC. 14. By majority vote the representatives pass resolutions on any matter pertaining to the society. Changes in the rules can be made only when the representatives have received notice in advance that such propositions are forthcoming, and when two-thirds of the representatives vote for their adoption at two successive meetings.

SEC. 15. Voting is done by raising the hand, or by ballot if one member of the meeting demands it. Ballots must not be signed.

SEC. 16. Directors and representatives receive free passage to and from the meetings over the shortest route by first-class steamship and second-class railway.

**APPENDIX III.—RULES OF THE SOCIETY FOR PROFITABLE
POULTRY BREEDING.**

[Translation by Andrew Fossum, Ph. D.]

SECTION 1. The society, whose headquarters are located at Copenhagen, exists for the sole purpose of breeding useful poultry, and to the exclusion of those used for sport.

SEC. 2. It strives to attain this object by (a) establishing as many centers as possible in all the counties, the especial duties of which shall be to exchange and distribute free of cost eggs and fowls of pure breeds, and to sell breeding stock, and freely to give advice in rational poultry breeding; (b) holding poultry shows in connection with the agricultural exhibitions in the provinces; (c) furthering in general the production and exportation of eggs and poultry; (d) awarding prizes to private poultry runs on the basis of their profitableness; (e) instructive lectures; (f) the eventual appointment of itinerant instructors or advisers in poultry keeping; (g) the eventual publication of a periodical.

SEC. 3. The members are: (a) Honorary members nominated by the directors and elected at a regular meeting of the representatives by a two-thirds majority; (b) extraordinary members, who, by paying once for all a fee of 50 kroner (\$13.40), are henceforth considered life members; (c) regular members, who pay to the society an annual fee of at least 2 kroner (53.6 cents); cottagers and those who are similarly situated, however, pay only 1 krone (26.8 cents) a year.

SEC. 4. Members may be admitted at any time by the directorate or by the representatives, and also at the poultry centers. Withdrawals, on the other hand, must be made in writing to the treasurer before the end of December. A member may be excluded from the society by a two-thirds vote of the directors. This decision can not be appealed.

Members pay their first annual fee when they are admitted to the society, and afterwards in the first half of the month of December; otherwise it is collected through the mails.

SEC. 5. The directorate consists of fifteen members, who elect their own officers, viz, president, vice-president, secretary, and treasurer. In the absence of the president the vice-president takes his place. The members of the directorate are elected at the regular meetings of the representatives, for three years. After the expiration of the first three years one-third retire annually, the first two times by lot, afterwards by turns. In case more than three members of the directorate withdraw or retire between the annual meetings of the representatives, the representatives must be summoned in extra session to fill the vacancies for the unexpired terms. Retiring members may be reelected.

SEC. 6. The president represents the society and calls a meeting of the directors as often as he deems it necessary. The directors also may demand a meeting.

The president presides at all the meetings of the directorate, and, in case of a tie, has the deciding vote.

SEC. 7. The secretary conducts the correspondence, superintends the distribution of the periodical, makes the announcements in the papers, assists the treasurer in preparing the financial statement, and keeps the minutes of the meetings of the directors and representatives. The representatives determine the annual salary of the secretary. The treasurer keeps the records and lists of members, sees to it that the fees are collected in accordance with section 4, and keeps an account of the finances. Under ordinary circumstances no bills must be paid without being previously referred to the president or vice-president.

SEC. 8. The society has, as already indicated in sections 4 and 5, a body of representatives who represent the members. The representatives shall number thirty-eight—two from each county. They are elected directly by the members in the

counties, for a term of three years at a time. After the lapse of the first three years one of the representatives retires by lot. The retiring member may be reelected.

SEC. 9. The representatives assemble ordinarily once a year before August 1, on a date fixed by the directors, but an extra meeting may be called at any time by the directors; also nineteen representatives, assigning the cause in writing to the directors, may demand an extra meeting.

SEC. 10. At the regular annual meeting of the representatives the president of the directors presents: (a) The report of the transactions in the past year; (b) the audited accounts for ratification; (c) a plan of work for the coming year; (d) a draft of instructions for the judges at the poultry shows.

Hereupon they proceed to elect the directors and two auditors to audit the accounts of the ensuing year.

SEC. 11. Any member of the society may attend the meetings of the representatives, but only representatives can vote. Members have everywhere free admission to the shows.

SEC. 12. The representatives must be informed by letter of the dates of the meetings, as well as the subjects for discussion, at least three weeks in advance. Any member of the society may send in a subject for discussion at the meeting of the representatives; it must, however, be sent to a representative at least four weeks before the meeting and by him forwarded to the president.

SEC. 13. The representatives are the last resort in the affairs of the society; a simple majority decides. In electing directors any member may demand a ballot; only such representatives as are present at a meeting are entitled to vote.

SEC. 14. After being laid before the directors, the statement of accounts is turned over by the president to the auditors before the end of February. It is later presented at the regular meeting of the representatives.

SEC. 15. It will be necessary that two-thirds of the representatives be present and that three-fourths of these vote for a motion in order to change the constitution or dissolve the society.

SEC. 16. Representatives are entitled to choose at least one deputy for each parish to assist them in the work of the society.

SEC. 17. The society pays the traveling expenses of the representatives and directors to and from the meetings by first or second class railway or steamer, and by the shortest route.

APPENDIX IV.—RULES GOVERNING THE DANISH COÖPERATIVE EGG EXPORT SOCIETY.

[Translation by Andrew Fossum, Ph. D.]

THE SOCIETY.

SECTION 1. The name of the cooperative society is the "Danish Cooperative Egg Export."

SEC. 2. The cooperative society, which came into existence on April 20, 1895, has, since April 20, 1900, been located and incorporated at Copenhagen. The main office may be transferred to any other place in Denmark whenever the directors and the representatives so decide.

SEC. 3. The principal object of the society is to provide the best possible market abroad for Danish eggs by guaranteeing to the customers that eggs, delivered with the registered trade-mark as fresh eggs, are absolutely new-laid and clean. Furthermore, it is the object of the society to protect in every way the interests of egg producers, and may include the preservation and the sale of eggs or the fattening of poultry belonging to members of the cooperative society, also to further promote well-conducted poultry breeding and poultry keeping.

THE CIRCUITS.

SEC. 4. The cooperative society consists of circuits of not less than ten members. Exceptions to this rule may be made by the joint action of the directors and the representatives. Every circuit that has joined the cooperative society is bound in every way by the laws in force from time to time. The directors of the circuit shall see to it that the rules of the circuit are in harmony with those of the society.

SEC. 5. When a circuit desires to join the cooperative society the directors of the circuit notify the president of the cooperative society in writing. Such an entrance is binding for at least one year. A copy of the rules of the circuit, signed by the directors of the circuit, and a membership list with the number, name, and occupation of each member, must accompany the notification. Furthermore, the circuit is required to pay, as an entrance fee, to the cooperative society, 50 öre [about 13½ cents] for each of its members. For each new member 50 öre [about 13½ cents] are likewise paid, unless the new member takes the place of a withdrawing member. The president of the cooperative society shall be immediately informed in writing by the president of the circuit of the admission of new members into the circuit. The directors may refuse the admission of circuits or members of circuits. Appeal from the decision of the directors can be made to the representatives and the general meeting. Withdrawal, which is effected in the same manner as admission, can be granted only on the first of January, after at least three months' notice.

SEC. 6. Each circuit that has been admitted into the cooperative society is required to deliver all the eggs collected from the members. Eggs over seven days old must not be delivered in the circuit. Violation of this rule, as well as delivering spoiled eggs, is punishable by a fine of 5 kroner [\$1.34], and, if repeated, the fine may be increased to 10 kroner [\$2.68]. At the beginning of each calendar year only 5 kroner are imposed for the first offense. One-half of the fine goes to the cooperative society and the other half to the circuit in question. The fine is imposed by the directors of the cooperative society, whose decision can not be appealed. The costs of a suit to collect the fine are paid by the one on whom the fine is imposed, the ordinance of August 6, 1824, notwithstanding.

SEC. 7. The circuits must not retain the eggs received more than four days before forwarding them to the society. The directors of the cooperative society may, however, according to circumstances, make exceptions in this matter, as well as in the time limit for delivering, heretofore mentioned in section 6. The eggs must be delivered absolutely clean, and, in order that their origin may be traced, must be distinctly stamped with the number of the circuit and the number of the member, according to the membership list. The society may refuse to accept eggs that do not answer these conditions, or discount them in price. In order that the stamping of eggs may be uniform, each circuit must provide its members with ink and rubber stamps from dealers approved by the society.

SEC. 8. If a circuit has not delivered all the eggs collected during the year to the cooperative society, or if it has kept the eggs beyond the time specified in section 7, it loses its share of the annual surplus and reserve fund for the year in question, and the directors of the cooperative society have, furthermore, the right to consider said circuit as having withdrawn at the close of the financial year.

The directors may exclude circuits or members of circuits. An appeal from such decision may be made to the representatives or to the general meeting, but not to the courts. The stamps of circuits that have withdrawn or have been excluded must be sent to the main office as soon as possible without reimbursement. Circuits or members of circuits that have withdrawn or have been excluded have no claims whatsoever to the property, surplus, or reserve fund of the cooperative society.

SEC. 9. The freight on eggs by railway or steamer is paid by the main office, but any amount exceeding 1 öre [less than one-half cent] per pound of eggs, net weight for each shipment, is charged to the circuit.

THE DIRECTORATE.

SEC. 10. The directorate consists of the president and four other members. They are elected by the general meeting—the president for five years and the other members for two years each, in such a manner that two withdraw in their turn each year. Members may be reelected at the expiration of their terms. The directors choose a vice-president from their own members. The executive committee consists of the president, manager, and a member elected by the directors from their own number. Two of its members may continue to fix the quotations on export eggs and sign papers on the part of the society. In case one of the directors dies or resigns, or for some other reason ceases to hold office, the representatives may fill the vacancy. If the president ceases to officiate, the vice-president may act and draw the salary of the president until the next regular general meeting, unless the directors deem it necessary to call an extra general meeting to fill the vacancy. Excepting the president, the members of the directorate draw no salary, but while performing their duties they receive 6 kroner [\$1.61] per day and traveling expenses by first-class steamer or second-class railway, as well as 1 krone [26.8 cents] per mile for conveyance by carriage.

SEC. 11. The directorate determines upon the methods of business, appoints a manager and the other permanent officers, but the representatives fix their pay. The president calls a meeting of the directors when he finds occasion to do so, or when at least three directors request it. If possible, the call is made seven days before the meeting. The president presides at the meetings; resolutions are passed by simple majority in such a way that a legal resolution always requires three votes. The president of the representatives is entitled to attend the meeting, but is without vote.

SEC. 12. The president directs the business of the cooperative society, being responsible for the management. He represents the society in courts. The salary of the president is 5,500 kroner [\$1,474] a year, and, by way of percentage, a half a krone [13.4 cents] per thousand of the volume of transactions of the last business year exceeding 3,000,000 kroner [\$804,000]. Traveling in the interests of the society the president receives the same allowance for expenses as the members of the directorate.

THE REPRESENTATION.

SEC. 13. The representative body, which consists of one member from each district, is chosen for four years, one-half retiring every other year. The election takes place at the regular general meeting, when the deputies assemble by districts and choose one representative for each district. Retiring representatives may be reelected. The representatives choose a president and vice-president from their own number to serve for two years. The president summons the representatives as often as he or five other members deem it necessary. A notice of seven days, if possible, should be given. At the meetings a secretary is chosen to keep the minutes in which the discussions and the votes are recorded. The minutes are signed by all the representatives after being read. The president presides at the meetings. The directors take part in the discussions, but have no vote.

SEC. 14. The directors must submit all important matters not pertaining to the daily routine to the representatives, unless a matter can not be delayed, in which case the directors decide and bring it before the representatives at a later date. Absolute majority, or at least ten votes, are required to decide a question. The representatives draw no regular salary, but receive the same daily pay and traveling expenses as the directors. If a representative dies, or withdraws, or resigns, or from some other cause ceases to act, the deputies of his district fill the vacancy at the first general meeting.

THE AUDITORS.

SEC. 15. The auditors are to be two business men nominated by the representatives and chosen by the general meeting for two years in each case; they retire in

alternate years, the first one by lot (at the end of the first year). Furthermore, two business men are chosen as substitutes. The auditors shall audit the accounts at least once a month. They have at all times unhindered opportunity to inspect the operations of the society, especially by examining the stock and the cash on hand, the books and accounts, other records, etc.

Should the auditors find occasion for censure, they shall report to the president of the society and the manager is required to comply with his directions until the matter can be decided at a meeting of the directors. When both auditors are agreed they can demand a meeting of the directors or of the representatives. The auditors may be summoned to the meeting of the directors, but they have no vote. The pay of the auditors is determined by the representatives, upon the recommendation of the directors.

THE GENERAL MEETING.

SEC. 16. The general meeting consists of the directors, the representatives, and a deputy from each circuit of at least ten members; the directors and representatives, however, have no vote unless they be deputies at the same time. The deputy must bring credentials from the directors of his circuit. A deputy from Bornholm may represent as many as five circuits.

SEC. 17. A regular general meeting shall be called annually in the last half of the month of March. Extra general meetings shall be held when the directors deem it necessary, or when demanded by one-tenth of the circuits or by one-half of the representatives. The extra general meeting shall be held within one month after such a demand has been made. The general meeting is called by the directors in writing to the presidents of the circuits at least fourteen days before the meeting. The call shall, so far as possible, be accompanied by the order of business. Time and place of meeting are announced in the organ of the society.

Propositions to be discussed in the regular general meeting must be reported to the president by February 20, and propositions to be discussed at the extra general meetings must be forwarded to the president when the demand for such meetings is made. Immediately before the regular general meeting the representatives hold a meeting at which all the matters in the order of the day of the general meeting are discussed; the representatives may, by a three-fourths majority, refuse to submit any of the matters to the general meeting, thereby causing them to be dropped from the order of the day; matters mentioned in section 19 and complaints which, according to sections 5 and 8, can be appealed to the general meeting are excepted.

SEC. 18. The general meeting elects a chairman, a secretary, and two tellers. The secretary shall keep a record of the transactions and votes of the general meeting. The record is signed by the chairman and the executive committee; it is admitted as full evidence regarding the transactions of the general meeting. Decisions are made by majority, except in cases where, according to the rules, a qualified majority is required. In case of a tie, the president's vote decides. Voting is done by ballot, if the president so decides, or at the request of at least twenty members. Admission cards to the general meeting must be shown in order to vote. On the motion of the executive committee or of the president, a deputy may be excluded from the general meeting by majority. This decision can not be made the cause of a lawsuit.

SEC. 19. At a regular general meeting the following is the order of business: (a) Report on the operations of the cooperative society in the past financial year; (b) to adopt the accounts, after being audited; (c) the eventual choice of a president; (d) to choose members of the executive committee; (e) the eventual choice of representatives; (f) the choice of one auditor and one substitute; (g) the selection of a place for the next general meeting.

THE RESERVE FUND.

SEC. 20. One-half of the net surplus of the previous year is paid in October to the circuits in proportion to the value of eggs delivered, while the remainder is put away

as a reserve fund. This is used in the business, but is credited in a separate account to the circuits in proportion to the value of eggs delivered.

The sums credited in this account can be paid only when the society is dissolved, unless in the opinion of the executive committee there is no use for the entire amount. The share in the reserve fund belonging to an individual member or to a circuit is not amenable to attachment by creditors, yet claims of the cooperative society against said parties are excepted. At the eventual settlement with the circuits the earliest series are paid off first. The shares of the circuit in the reserve fund draw an annual interest of 4 per cent, which is paid at the same time as the surplus.

THE MANAGEMENT.

SEC. 21. The money of the society must be deposited in the bank designated by the representatives. Payments are made by the bank on the order of two members of the executive committee. The payments to the circuits for the eggs that have been received shall be made as soon as possible.

SEC. 22. Under the supervision of the president, the manager is in charge of the daily operations in accordance with the instructions received from the executive committee. He is to keep the storehouse and contents insured against fire and the eggs shipped insured against losses at sea.

SEC. 23. The president, manager, treasurer, and branch managers must give sufficient bonds for the property entrusted to them. Contracts and affidavits are brought before the representatives for ratification.

SEC. 24. The cooperative society can only be dissolved by a two-thirds majority vote at two successive general meetings. Changes in the rules can only be made when at least two-thirds of the members present at the general meeting thus decide.

SEC. 25. At the eventual dissolution of the society its property shall be turned into cash. Thereupon all the outside obligations of the society shall be paid first. In case a part of the reserve fund is used for this purpose, the remainder is divided among the circuits in proportion to the amounts with which they are credited in the account of the reserve fund. In case there is a surplus on hand, it is to be divided among the circuits in proportion to the value of the eggs delivered in the financial year immediately preceding the dissolution.

SEC. 26. These rules go into effect April 1, 1902.

Adopted in the general meeting at-Copenhagen March 22, 1902.

Rules of Circuit No. — of the Danish Cooperative Egg Export Society.

SECTION 1. The circuit belongs to the cooperative society "The Danish Cooperative Egg Export" and is required to conform to the rules of the same that are in force from time to time.

SEC. 2. Members are admitted by applying to the directors of the circuit. Each member pays to the Danish Cooperative Egg Export 50 öre [about 13½ cents] as admission fee and 1 öre per hen to the circuit.

SEC. 3. All members are, without any declaration on their part, subject to the circuit laws as they now are or as they may be legally changed hereafter.

SEC. 4. Members are required to deliver all the eggs (so many as are required for the household or for setting or have been casually found are excepted) in such a way and at such times as are fixed by the directors of the circuit. This agreement is binding for one year at a time.

SEC. 5. Eggs over seven days old must not be delivered. A violation of this, as well as delivering spoiled eggs, is punishable by a fine of 5 kroner [\$1.34], imposed by the directors of the cooperative society; and, if repeated, the fine may be increased to 10 kroner [\$2.68]. One half of the fine goes to the Danish Cooperative Society,

the other half to the circuit in question. The finding of the directors of the parent society is not subject to appeal, in spite of the decision of the circuit directors or the egg collector. In case of a suit to collect the fine the expenses are paid by the party on whom the fine was imposed, the ordinance of August 6, 1824, notwithstanding.

SEC. 6. The eggs must be carefully gathered once a day and during the hot season at least twice a day. Eggs that have been casually found must not be delivered. Only artificial eggs must be used as nest eggs, and the hens must be excluded from the nests at night.

SEC. 7. Only clean eggs are to be delivered, and they must be protected against sun, rain, and frost by producers as well as egg collectors.

SEC. 8. The members must deliver to the circuit eggs from their own poultry only; the violation of this rule is punished in the first instance by a fine of 25 öre [nearly 7 cents]—afterwards 50 öre—a pound of the eggs that have been delivered contrary to these rules.

SEC. 9. The membership list of the circuit shall have the number, name, and occupation of each member, and a member's number on the list shall be that with which he stamps his eggs. The president of the circuit shall report changes in the list to the main office of the cooperative society. By paying about 25 öre [nearly 7 cents] each member receives a rubber stamp, ink, and pad. The stamp has the number of the circuit and of the member, and the member must use it to stamp neatly and distinctly the large, thick end of every egg before delivering.

SEC. 10. The egg collector will accept only eggs that are clean and that have been distinctly and properly stamped.

SEC. 11. The directors of a circuit may temporarily refuse to accept the eggs of a member, and a member may be excluded by a majority vote of a general meeting or by the directors of the cooperative society.

SEC. 12. The necessary money to pay cash for the eggs of the members is borrowed; the members are liable for the debt individually and as an organization, and the money is paid out to the egg collector, who gives satisfactory bonds.

SEC. 13. The eggs are paid for at prices fixed by the directors of the circuit. What the eggs bring over and above this price is paid to the members only after a sum sufficient, in the judgment of the directors, to run the business has been put aside.

SEC. 14. A withdrawal is reported to the directors of the circuit, but the connection ceases only after the close of the financial year. Members that have withdrawn or been excluded have no claim to the surplus, reserve fund, or to any property belonging to the society, and must without reimbursement surrender their stamps to the president of the circuit.

SEC. 15. The directors of the circuit consist of an uneven number of members, namely —, and are chosen by the general meeting (of the circuit).

SEC. 16. The duty of the directors of the circuit is to see to it that the business of the circuit is furthered in the best manner possible by taking such measures as shall insure the delivery of the eggs to the cooperative society in the condition required. The directors of the circuit appoint and dismiss the egg collector and others employed in the business of the circuit, determine their pay, and supervise their work.

SEC. 17. The general meeting elect annually two auditors to audit the accounts of the year before the end of January of the following year.

SEC. 18. The regular general meeting is held in the beginning of February, so early that propositions, if any, to the directors of the parent society, may be forwarded to its president before the 20th of February.

SEC. 19. The circuit sends one deputy to the general meeting of the cooperative society.

SEC. 20. When the circuit is eventually dissolved and all obligations paid, the remaining assets, if any, shall be divided among the members in proportion to the value of the eggs delivered during the last financial year.

Adopted at a general meeting at —, 19—.

[Continued from 2d page of cover.]

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(Continued on page 3 of cover.)

U. S. DEPARTMENT OF AGRICULTURE,

BUREAU OF ANIMAL INDUSTRY.—Bulletin No. 66.

D. E. SALMON, D. V. M., Chief of Bureau.

THE GID PARASITE (*CŒNURUS CEREBRALIS*): ITS PRESENCE IN AMERICAN SHEEP.

BY

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF ANIMAL INDUSTRY,
Washington, D. C., October 21, 1904.

SIR: I have the honor to transmit herewith a manuscript entitled "The Gid Parasite (*Cenurus cerebralis*): Its presence in American Sheep," by B. H. Ransom, B. Sc., A. M., scientific assistant in charge of the zoological laboratory of this Bureau.

This parasite in its bladderworm stage (*Cenurus cerebralis*) causes the disease called gid, otherwise known as "sturdy," "staggers," etc., which principally affects sheep, although cattle and other herbivorous animals are also susceptible. It is transmitted to stock through pasture or water which has been contaminated by the eggs of a certain species of tapeworm (*Tænia cænurus*) parasitic in the intestines of dogs, the latter having acquired the parasite by feeding upon the carcasses of stock infested with the bladderworm stage. Although a common disease in Europe, where it frequently occasions losses of fully 10 per cent in flocks of sheep, gid has until very recently been unknown in the United States. Early in the present year, however, a well-authenticated outbreak occurred in the sheep-grazing regions of the West, and it was, consequently, deemed expedient to publish such facts as would help our stockmen to protect themselves against possible outbreaks in the future.

The information concerning gid herein set forth is of much practical importance to sheepmen, as it enables them to recognize the disease should it make its appearance, and indicates the measures best calculated to prevent its spread. I therefore recommend that the work be published as Bulletin No. 66 of the series of this Bureau.

Respectfully,

D. E. SALMON, *Chief of Bureau.*

Hon. JAMES WILSON,
Secretary of Agriculture.

CONTENTS.

	Page
Introduction	7
Presence of gid in the United States	8
Historical review of gid	8
Economic importance of gid	9
Description of the gid bladderworm (<i>Cenurus cerebralis</i>)	10
Description of the gid tapeworm (<i>Tænia caninus</i>)	12
Life history of the gid parasite	14
Susceptibility of sheep and other animals	16
Symptoms—	
Cephalic gid	16
Medullary gid	17
Pathology	17
Diagnosis	20
Treatment	20
Prevention	20

ILLUSTRATIONS.

	Page.
FIG. 1. Gid bladderworm (<i>Cenurus cerebralis</i>), showing the heads	10
2. Diagrammatic section of a gid bladderworm	11
3. Larval tapeworm head dissected away from the wall of a gid bladderworm	11
4. Hooks from the gid bladderworm	12
5. Hooks from a bladderworm of the rabbit (<i>Cenurus serialis</i>)	12
6. Portions of an adult gid tapeworm (<i>Tænia caninus</i>)	13
7. Sexually mature segment of the gid tapeworm	13
8. Gravid segments of tapeworms of dogs, showing the median stem of the uterus and its lateral branches	14
9. Gravid segment of <i>Tænia serialis</i> , a tapeworm of dogs often confused with <i>T. caninus</i>	15
10. Brain of lamb showing the furrows produced by the migration of young gid bladderworms	15
11. Skull of a sheep showing the brain infested with a gid bladderworm ..	18
12. Sheep's skull, showing perforations resulting from the presence of gid bladderworms	19

THE GID PARASITE (*CŒNURUS CEREBRALIS*): ITS PRESENCE IN AMERICAN SHEEP.

By B. H. RANSOM, B. SC., A. M.,

Scientific Assistant in Charge of Zoological Laboratory, Bureau of Animal Industry.

INTRODUCTION.

The disease popularly known by English-speaking peoples as gid, sturdy, staggers, turnsick, etc., which affects sheep, and, more rarely, cattle and other animals is a common disease of stock in Europe. It is said to occur also in South America, and is now known to occur in this country. The cause of this disease, a characteristic symptom of which is vertigo and turning of the affected animal, is the presence of a parasite, the gid bladderworm (fig. 1), in the brain or spinal canal.

The gid bladderworm, or *Cœnurus cerebralis* as it is known technically, is the larval stage of a tapeworm, *Tœnia cœnurus* (fig. 6), which is found in the intestines of dogs. When the brain of a "giddy" sheep is eaten by a dog, the bladderworm develops into tapeworms in the intestines of the latter. The tapeworms produce eggs, which pass out of the dog's intestines and fall to the ground, where they may lie amid the grass or be washed by rains into pools of water. Sheep and cattle while grazing or drinking are liable to swallow these eggs, which then hatch out, and the embryos, boring out of the intestines, wander to the brain or spinal cord, where they undergo further development and give rise to the condition known as gid.

It seems reasonable to suppose, in view of the large numbers of sheep and dogs which have been imported into the United States from countries where gid is common, that the disease should have become more or less prevalent here also, but for some reason the gid parasite has never gained a foothold in North America, and until very recently, so far as it has been possible to determine, gid has been entirely unknown in this country. A possible exception may be based on the mention made by Leidy (1856) of "*Cœnurus cerebralis* Rud. in the sheep, *Capra aries*," but neither the time nor the place of the collection of the specimens referred to by that author is known. Although heretofore no cases of gid in this country have been placed on record, it seems hardly probable, in view of our present knowledge, that the disease

has been altogether absent. More likely, cases have occurred from time to time and passed unrecognized, as evidence has come to hand which shows that the disease is now present in the United States, cases having developed recently which, as the attendant circumstances show, must have resulted from infection in this country.

PRESENCE OF GID IN THE UNITED STATES.

A number of native sheep died at Bozeman, Mont., in January, 1904, with the characteristic symptoms of gid. These sheep were brought to the notice of officials of the Montana Agricultural College. On postmortem examination, bladderworms were found in the brain, and through the courtesy of Professor Cooley two specimens (B. A. I. Collection, No. 3644, figs. 3, 4) have been placed at the disposal of this laboratory. These specimens agree in all essentials with the European *Cœnurus cerebralis*, so far as may be determined from published descriptions of the latter, no specimens for comparison being at present available. The salient characteristics of the American form are as follows: Each specimen is nearly spherical, with a diameter of about 25 mm. (about 1 inch). There are no secondary or daughter bladders, either internally or externally. The wall of the bladder consists of a thin semitransparent membrane, and its surface is marked by several groups of little white spots, the invaginated heads, or scolices, of the larval tapeworms, which number over a hundred in each specimen. Each head is supplied with a double crown of 30 to 32 hooks, of two sizes, arranged alternately (figs. 3, 4). The larger hooks measure 160 to 170 μ ($\frac{1}{16}$ to $\frac{1}{15}$ inch), and the smaller hooks 114 to 130 μ ($\frac{1}{16}$ to $\frac{1}{15}$ inch) in length. In the latter the ventral root is slightly bifid.

Although at present the gid parasite may be causing but little damage in the United States, the fact should be remembered that its history in other countries has shown it to be one of the most dangerous parasites to which sheep are subject, and the possibility kept in view that it may in the future become more widespread and prevalent in this country, and that, in this event, serious losses are liable to occur. Stock raisers, veterinarians, and all persons interested in live stock, especially sheep, should therefore be on their guard against the gid parasite, and, by taking proper preventive precautions—to be discussed later—avoid in this country a possible repetition of the disastrous experience of stock raisers abroad.

HISTORICAL REVIEW OF GID.

Gid has been known for nearly three hundred years, and possibly longer, it having been traced in literature as far back as 1634. In that year a European surgeon named Reutten observed a sheep

affected with vertigo, and another surgeon, Scultetus, on making a postmortem examination of the animal, discovered in the brain a vesicle filled with a limpid fluid. After this date the disease and the vesicle in the brain with which it is associated were noted by various authors, who attempted to explain in various ways the cause of the disease and advanced numerous theories to account for the presence of the vesicle. Methods of operation for the removal of the vesicle were also described, but not until the latter part of the eighteenth century was the true nature of the watery vesicle in the brain of "giddy" sheep and cattle pointed out. In 1780 Leske demonstrated the animal nature of the vesicle by the discovery of tapeworm heads attached to its surface. Many years later another step was accomplished in solving the question of the etiology of gid when Siebold (1852) discovered that if the gid bladderworm is fed to a dog it develops into mature tapeworms in the intestines of the latter. The following year Küchenmeister (1853) showed further that the eggs from tapeworms thus produced in dogs, when fed to sheep, develop into bladderworms in the brain. Since that time the experiments of Siebold and Küchenmeister have been many times repeated, and the relation between *Cenurus cerebralis* in the brain of sheep and other animals and *Tænia cænurus* in the intestines of dogs, as larval and adult stages, respectively, in the life history of a single species of parasite, has been most firmly established.

ECONOMIC IMPORTANCE OF GID.

Gid was soon recognized in Europe, after its first discovery, as one of the most important diseases of sheep; large numbers of animals were lost annually from this cause, and at times in some localities the flocks were almost annihilated.

The following quotations from the literature on the subject will serve to indicate the important nature of the disease, and will give some idea of the damage which has been caused by the gid parasite in countries where it has been prevalent. It will be noticed that most of the authors quoted refer to conditions which existed before the life history of the parasite was known and before the proper means for its prevention were recognized. The percentages given will, in general, probably not apply at the present time, as many stock raisers of Europe have long since realized the practical value of preventive measures, and this has resulted in a material reduction of the general mortality from gid, although in isolated cases where proper precautions are neglected the former high percentage of mortality is still the rule.

Wepfer (about 1659) reported an epizootic of the disease which occurred in the year 1650 among cattle in a certain locality of Germany. In 1752 there were great losses from gid among both sheep

and cattle in Iceland. Sooner or later the disease attracted attention in almost every country in Europe.

Tessier (? 1810), according to Numan (1850), placed the annual loss of sheep from gid in France at about 5 per cent. Kuers (1840) estimated the loss in Germany at about the same figure, and Fricke (1844) stated that in his own flocks the losses at one time reached as high as 10 per cent. Numan (1850) states that, while the disease is well known in Holland, it is not so common as in some other countries, although at times it assumes the character of an epizootic. He further states that in some parts of Germany and Austria the loss is 10 per cent, and that in many localities the sheep industry has declined seriously in consequence.

Fleming (in Neumann, 1892) quotes a statement of Youatt that in France 1,000,000 sheep die annually from gid, and states that Gasparin has put the losses in Germany at 15 per 1,000 in the first year of life, 5 in the second year, 2 in the third year, and 1 in the fourth. In England, where the disease is more or less prevalent, the number of sheep lost in some flocks has reached as high as 35 per cent (Veterinarian, 1871, p. 547).

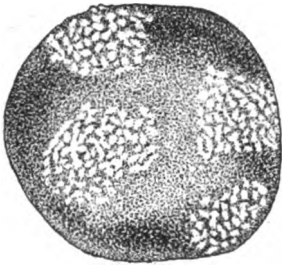


FIG. 1.—Gid bladderworm (*Cœnurus cerebralis*), showing the heads, each one of which represents an immature tapeworm. Natural size. (After Railliet, 1886, p. 245, fig. 137.)

Armatage (1895) estimates the annual losses in Great Britain at about 10 per cent, and states that gid "always prevails in some districts, particularly in Scotland, and upon all unclosed lands where sheep are gathered in large flocks and attended by dogs."

As an illustration of the extent to which a single flock may be invaded by gid, an instance observed by Brunet (1875) in the Bas Berry region, France, may be referred

to. In this case over 80 sheep in a flock of 212, or about 40 per cent, were affected.

DESCRIPTION OF THE GID BLADDERWORM (*CŒNURUS CEREBRALIS*).

(Figs. 1-4, 10-12.)

Cœnurus cerebralis, the larval stage of the gid parasite, is most frequently found in the brain of sheep and more rarely in the spinal cord. It has also been found in other herbivorous animals—ox, goat, reindeer, roedeer, antelope, dromedary, and horse. No authentic case of *Cœnurus cerebralis* in man has been recorded. A number of isolated cases are on record in which bladderworms resembling *Cœnurus cerebralis*, and probably identical with it, have been found in locations other than the brain. Eichler and Nathusius have reported such bladderworms in the subcutaneous tissue of sheep, and Heincke (1882) has

recorded the presence of a *Cenurus* in the eye of a horse. Rabe (1889) discovered in the brain, muscles, lymphatic glands, and thyroid body

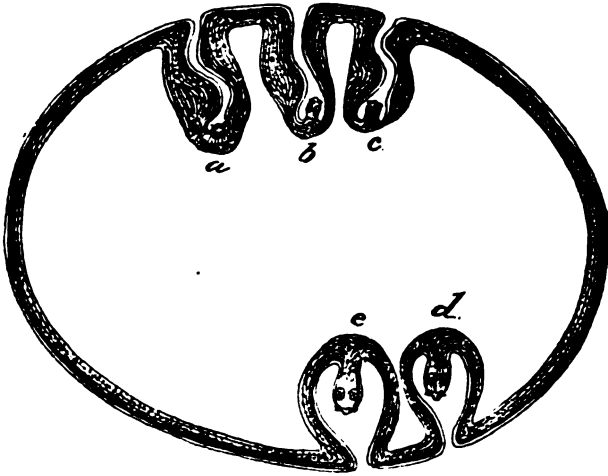


FIG. 2.—Diagrammatic section of a gid bladderworm (*Cenurus cerebralis*): a, normal disposition of scolex; b, c, d, e, diagrammatic representation to show the homology between cysticercus and cenurus. (After Railliet, 1886, p. 243, fig. 134.)

of an antelope specimens of a bladderworm which he identified as *Cenurus cerebralis*. In general, however, *Cenurus cerebralis* fails to develop in any other location than the central nervous system, and the embryos which do not succeed in reaching the brain or spinal cord soon degenerate.

The bladderworm (figs. 1, 2) consists of a membranous vesicle, the wall of which bears numerous small invaginations resembling tapeworm heads (fig. 3), each one of which, when swallowed by a dog, is capable of transforming into an adult tapeworm, *Tenia cenurus*. In its growth the vesicle tends to assume a spherical form and attains a size varying from that of a hazelnut to that of a hen's egg. The form of the bladder



FIG. 3.—Larval tapeworm head dissected away from the wall of a gid bladderworm (*Cenurus cerebralis*). X 38. (Original drawing, specimen No. 3644, B. A. I. Helminthological Collection.)

is modified according to its location. When situated in the spinal canal it becomes much elongated. The wall of the bladder is very

thin, translucent, and contains contractile fibers. It is filled with a colorless, watery fluid containing 1 to 2 per cent of animal matter and less than 1 per cent of inorganic salts. The heads of the larval tapeworms, which appear as little white spots arranged in irregular groups and usually confined to one region of the vesicle, probably corresponding to the posterior part of the embryo, may number more than 500 in a single specimen, but usually they are not so numerous. They are generally found invaginated and project into the interior of the vesicle; but Davaine (1858) has observed that they are capable of

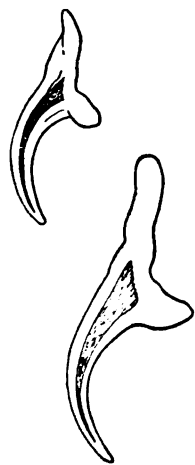
evagination, and thus become an active source of irritation to the brain. Not all of the heads are found equally developed. Some of them can not be distinguished from the head of the adult, while others are rudimentary.

The hooks, suckers, and other details of the head are similar in the larva and in the adult, and will be described in connection with the description of the latter.

DESCRIPTION OF THE GID TAPEWORM (*TÆNIA CÆNURUS*).

(Figs. 6-8, see also figs. 3-5, 9.)

FIG. 4.—Hooks from the gid bladderworm (*Cœnurus cerebralis*). X 240. (Original drawing, specimen No. 3614, B. A. I. Helminthological Collection.)



Tænia cœnurus, the adult stage of the gid parasite, is found in the intestines of dogs, and is said to occur also in foxes, and probably also in wolves.

It is not known to occur in other animals. Another tapeworm of the dog, *Tænia serialis*, is often mistaken for it. (Compare figs. 4, 5, 8C, 9.)

Omitting an extensive discussion of the anatomy of the worm, the essential characteristics of *Tænia cœnurus* are as follows:

The average length is 40 to 60 cm. (16 to 24 inches) and the maximum 1 meter (40 inches). It possesses a head, or scolex, an unsegmented neck, and a long segmented portion consisting of two hundred to two hundred and fifty segments, or proglottids (fig. 6).

The fully developed head is pyriform and measures about 0.8 mm. ($\frac{3}{8}$ inch) in diameter. It is supplied with four suckers, 0.30 mm. ($\frac{3}{8}$ inch) in diameter, and a rostellum, also about 0.30 mm. in diameter, bearing a double crown of 22 to 32 hooks (fig. 4) of two kinds, large and small, arranged alternately. The suckers and rostellum

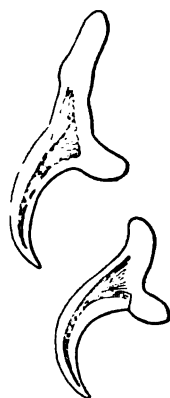


FIG. 5.—Hooks from a bladderworm of the rabbit (*Cœnurus serialis*, the larval stage of the tapeworm of the dog, *Tænia serialis*). X 240. (Original drawing, specimen No. 1823, B. A. I. Helminthological Collection.)

serve to attach the worm to the intestinal wall of its host. The large hooks measure 150 to 170 μ ($\frac{1}{16}$ to $\frac{1}{8}$ inch) and the small hooks 90 to 130 μ ($\frac{1}{16}$ to $\frac{1}{8}$ inch) in length.

The neck is slender and 2 to 3 mm. ($\frac{1}{8}$ to $\frac{1}{4}$ inch) long. In the region of the neck the segments (fig. 6) are very short and narrow, but toward the posterior end of the worm they gradually increase in size. The last twelve to fifteen segments are much longer than broad, in form somewhat resembling cucumber seeds, and measure 8 to 9 mm. (about $\frac{1}{2}$ inch) long by 3 to 5 mm. ($\frac{1}{4}$ to $\frac{1}{2}$ inch) broad. Near the middle of the right or left lateral margin of each segment is a small opening—the genital pore.

During the life of the worm new

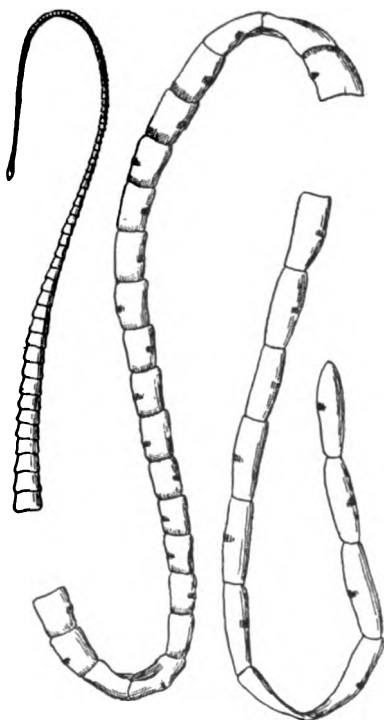


FIG. 6.—Portions of an adult gid tapeworm (*Tænia cernurus*). Natural size. (After Railliet, 1893, fig. 146, p. 252.)

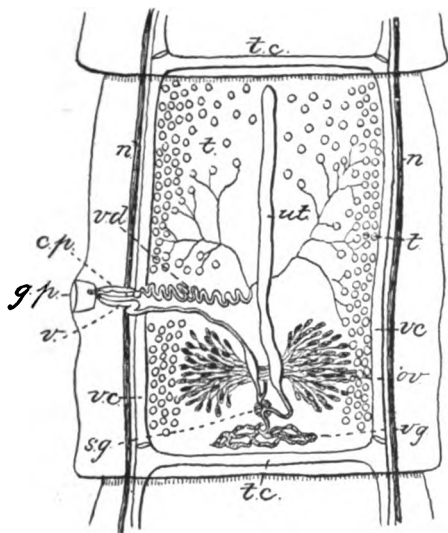


FIG. 7.—Sexually mature segment of the gid tapeworm (*Tænia cernurus*) showing: cp, cirrus pouch; gp, genital pore; n, nerve; or, ovary; sg, shell gland; t, testicles; tc, transverse canal; ut, uterus; v, vagina; vc, ventral canal; vd, vas deferens; vg, yolk gland. X 20. (After Deffke, 1891, pl. 1, fig. 3.)

segments are continually being added in the neck region by a process of intercalation. The segments when first formed are small and sexually undeveloped. Gradually, however, they are pushed backward by still younger segments which develop

in front of them. They grow larger in all dimensions, and the sexual organs develop (fig. 7), reach maturity, and produce eggs, which are stored up by thousands in the uterus of each segment. Finally the gravid segments break away from the end of the chain and pass out of the dog's intestine. It results from this manner of growth that the small segments farthest anterior are the youngest, and the

large hindermost segments are the oldest; thus, in a single worm, segments in all stages of development may be found.

The most conspicuous structure in the posterior segments (fig. 8C) is the uterus filled with yellowish or brownish eggs. The gravid uterus has a median stem with eighteen to twenty-six lateral branches

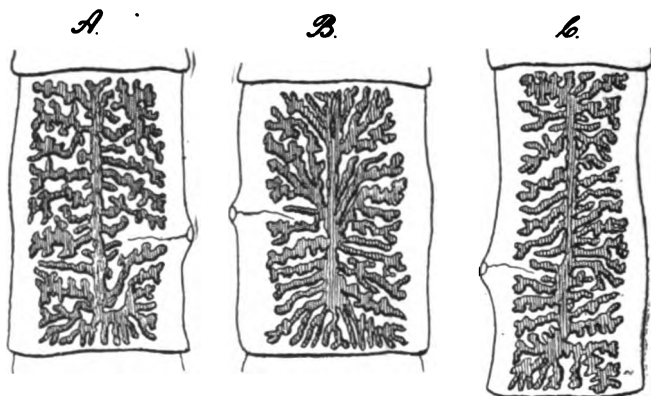


FIG. 8.—Gravid segments of tapeworms of dogs, showing the median stem of the uterus and its lateral branches. (A) *Taenia serrata*, X 4; (B) *T. marginata*, X 6; (C) *T. caninus*, X 10-15. (After Leuckart, 1880, p. 720, fig. 308.)

on each side. The latter are almost parallel to each other, and are unbranched or only slightly branched.

The eggs, found in the gravid uterus, contain embryos with six hooks and measure from 31 to 36 μ (about $\frac{1}{100}$ inch) in diameter.

LIFE HISTORY OF THE GID PARASITE.

As already stated, the gid bladderworm, *Cenurus cerebralis*, and the tapeworm, *Taenia caninus*, are intimately related, the former being the larval stage of the latter.

In detail the life history is as follows: A dog infected with *Taenia caninus* scatters the eggs and gravid segments of the tapeworm over the ground. Those eggs which fall into moist places may live for several weeks, but those exposed to hot, dry weather preserve their vitality only a few days at most. Sheep and cattle while grazing or drinking are liable to swallow some of the eggs thus spread broadcast by the infested dog. By the action of the digestive juices the shells of the eggs are dissolved and the embryos contained set free. The embryos then bore out of the intestine by means of their hooks and wander among the tissues. This migration is undoubtedly aided by the blood current in vessels penetrated by the embryos, which are thus carried passively to various parts of the body. Normally only those embryos which reach the central nervous system continue their development. Others failing to reach this location may live for a while, but generally die and soon disappear. After reaching the

brain or spinal cord, which may occur within eight days after infection, the embryo loses its hooks and transforms into a small cyst. The young *cœnurus* preserves its power of locomotion for some time and may burrow along the surface of the brain, leaving a shallow, sinuous furrow (fig. 10) in its wake, but within a few days it becomes stationary. These furrows are to be found fourteen to thirty-eight days after infestation; near the termination of each is a small vesicle, the young gid bladderworm. As determined experimentally by Baillet, the vesicle, two or three weeks after infestation, has attained a diameter varying from 0.6 to 3 mm. ($\frac{1}{4}$ to $\frac{1}{2}$ inch); on the twenty-fourth day it is as large as a pea, but the wall still remains thin and transparent. The heads begin to appear by the thirty-eighth day, when the vesicle has reached the size of a cherry, but they do not seem to attain their full development before the end of two or three months. The vesicle, however, continues to grow, and new heads are in continuous process of formation, so that in addition to fully formed heads, very rudimentary heads and intermediate stages between the two are likely to be found on the surface of the same bladder.

When a brain containing a bladderworm is eaten by a dog, the wall of the vesicle is digested, but the heads remain uninjured by the digestive juices and attach themselves to the wall of the intestine and

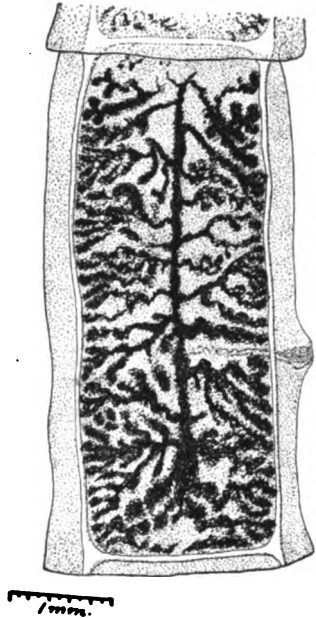


FIG. 9.—Gravid segment of *Tænia scrialis*, a tapeworm of dogs often confused with *T. cœnurus*. X 14. (Original drawing, specimen No. 2839, B. A. I. Helminthological Collection.)

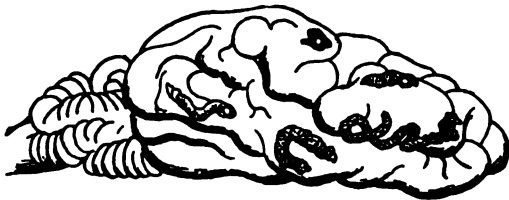


FIG. 10.—Brain of lamb showing the furrows produced by the migration of young gid bladderworms, taken at a time immediately following the period of invasion—i. e., from fourteen to thirty-eight days after infestation. Natural size. (After Leuckart, 1879, fig. 81, p. 173.)

develop into the adult tapeworm. In one to two months the posterior segments of the worm become gravid with eggs, and breaking away from the rest of the chain begin to pass from the dog's intestine.

SUSCEPTIBILITY OF SHEEP AND OTHER ANIMALS.

Gid is exceptional in sheep over two years old, the great majority of animals which present symptoms of the disease being lambs and yearlings. The disease is more rare among cattle and goats, and still more rare in other animals. Cattle seem to be susceptible for a longer period than sheep, and although gid is more frequent in calves and yearlings, animals as old as five or six years are still subject to infestation.

Certain breeds of sheep seem to be more susceptible than others, and in some cases this has been explained by the fact that some breeds graze closer to the ground and thus are more liable to take in tape-worm eggs and segments than others. The greater susceptibility of young animals has not been fully explained, but it has been supposed that the embryos of the worm are unable to penetrate the firmer tissues of adult animals, and consequently do not reach the brain.

SYMPTOMS.

The following account of the symptoms of gid is based mainly on the description of the disease in sheep, given by Neumann (1892). The symptoms in cattle and other animals are of the same general character as those in sheep, showing minor differences probably in correspondence with the different natures of the animals affected. The type of symptoms varies according as the bladder worm is located in the brain or spinal cord. If the parasite is located in the brain it gives rise to *cephalic gid*; if in the spinal canal, to *medullary gid*.

Cephalic gid.—Unless the infestation is very heavy no symptoms are likely to appear during the stage of invasion of the parasites, or they may be slight and pass unnoticed. When early symptoms occur they appear generally in the second or third week following infestation. The affected animal shows signs of congestion of the brain, there is indifference and weakness, the head is of unusually high temperature and is held in an abnormal position, and the eyes are inflamed. Peculiar actions may become evident.

Frequently the animal turns in circles, or wheels about in one spot as on a pivot. In some cases it staggers about as though intoxicated, stumbles, and often falls. The eyes are turned in or out, there is grinding of the teeth, and sometimes convulsions. The animals may die in a few days in severe cases, but generally the symptoms disappear in eight or ten days, and a period of apparent recovery follows, corresponding to the period of growth of the parasite. In about 2 per cent of animals attacked the parasites apparently die, as no later symptoms develop, but in the vast majority of cases, at the end of four to six months, symptoms appear which mark the final stage of the disease, leading almost invariably to a fatal termination within a few

weeks at most. Usually these symptoms are the first to be noticed, as the initial symptoms are generally so slight that they pass unrecognized. Prior to the onset of the final symptoms and during the growth of the parasite certain slight signs of an abnormal condition of the brain will be noticed from time to time by the careful observer, especially in stormy weather. The time at which the symptoms of the final stage of the disease appear varies somewhat and according to the time at which infestation occurred, but it is generally toward the end of winter or in the spring. The symptoms at this stage may be considered as due in part to the pressure of the *cœnurus* bladder on the brain, and in part to the active irritation produced by the larval tapeworm heads which are capable of being thrust out from the surface of the bladder. The symptoms vary according to the region of the brain occupied by the parasite.

Generally, however, the affected sheep holds his head in an unusual position, his eyes are fixed, with dilated pupils, and he pushes against obstructions. He becomes feeble, loses his appetite, and lags behind the flock. He moves in circles which gradually become smaller and smaller until he turns as on a pivot, and he usually turns toward the side on which the brain is compressed. If the parasite is located in the anterior part of the brain, the sheep is likely to move straight forward, holding his head down and lifting his feet high. A great variety of other movements may be executed, the type of movements depending upon the locality of the brain affected. A characteristic of all these peculiar actions is their automatic and intermittent nature. They recur several times during the day, and may continue to appear during a period of four to six weeks, at the end of which the animal dies from paralysis or exhaustion.

Medullary gid.—When the gid parasite is located in the spinal cord it generally occurs in the lumbar region, and the disease is then termed lumbar gid, or hydatid paraplegia.

The chief symptom of lumbar gid is the gradually increasing weakness and paralysis of the hind quarters. The bladder and rectum become paralyzed, the wool is shed, and the animal becomes progressively thinner, although he may retain his appetite and eat enormously. This condition may persist for several months before death occurs from general debility and exhaustion.

PATHOLOGY.

(Figs. 10-12.)

Neumann (1892) gives the following account of pathological lesions occurring in gid:

Pathological anatomy.—At the autopsy of animals which have died of gid one or more *Cœnurus* are found in the cranium, as much more developed as the disease has been prolonged. When speaking of its etiology, and of the experiments which have

established this, the developmental phases of the parasitic vesicle were described. In practice, the number of Cœnures is generally limited, though Huzard has counted more than thirty in the head of a lamb. Their size and development are generally in inverse proportion to their number. Huzard has seen some which occupied nearly one-half of the cranial cavity.

These vesicles are found at various parts of the brain. When they are small and deeply situated they are surrounded by a pseudopurulent exudate, which is yellow and creamy in places. If the Cœnurus is voluminous the brain substance in its

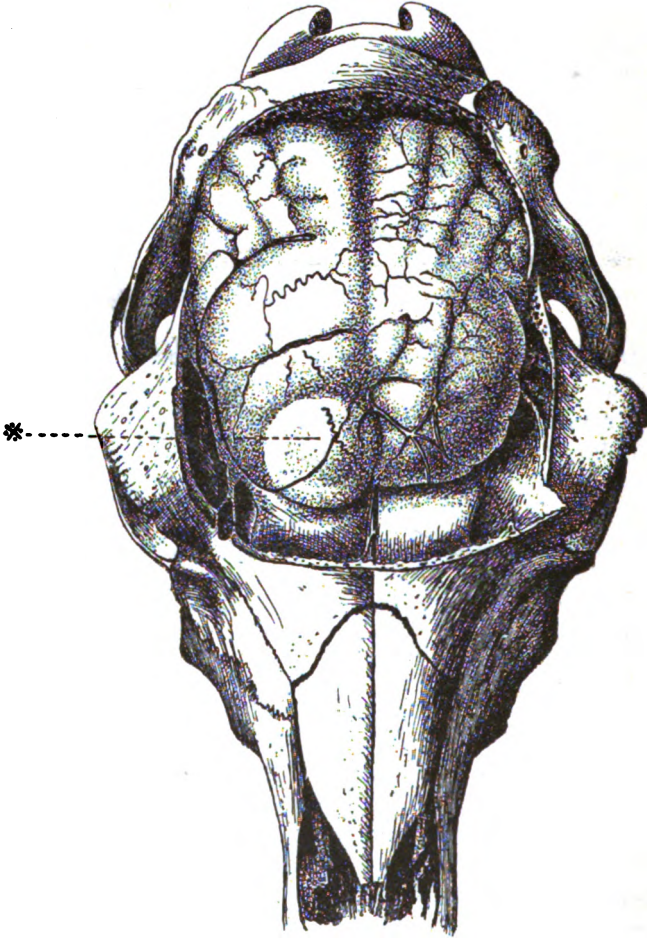


FIG. 11.—Skull of a sheep showing the brain infested with a gld bladderworm (*Cœnurus cerebralis*), two-thirds natural size. (After Railliet, 1886, p. 244, fig. 135.)

vicinity is depressed, atrophied, wasted, and forms a more or less regular pouch, the wall of which is formed of flexuous, interrupted, or broken nerve tubes that are less numerous than in the normal substance; by nerve cells which are no longer in communication with the nerve tubes; by a large quantity of amorphous substance and molecular granules; and lastly, by calcareous crystalline particles. Capillary vessels traverse this layer, and are continuous with those of the cerebral substance (Robin, quoted by Reynal). This pouch contains a grumous purulent matter, and the peripheral cerebral substance is inflamed, dense, and granular.

When the *Cœnurus* is in a ventricle, the roof of this is thinned and sometimes reduced to its envelopes; the septum lucidum, posterior pillar of the fornix and the corpus callosum are also thinned, and even perforated, and pushed toward the hemisphere or into the opposite ventricle, into which the vesicle sometimes protrudes.

The old and voluminous *Cœnures*, situated on the superficial parts of the brain, have, by compression, caused absorption and attenuation of the roof of the cranium, which yields to pressure of the fingers (fig. 12).

In medullary gid the *Cœnurus* is elongated, fusiform, and from 3 to 5 cm., and even a foot long (Numan). Usually there is only one and it is lodged in the lumbar region; it may, however, occupy the cervical region (May), or the posterior part of the medulla oblongata (Störing). In some cases it has undergone calcareous degeneration and is only recognizable by its hooks, which have persisted (Röll). It sometimes only occupies one-half of the spinal cord, sometimes the two divisions, or it is

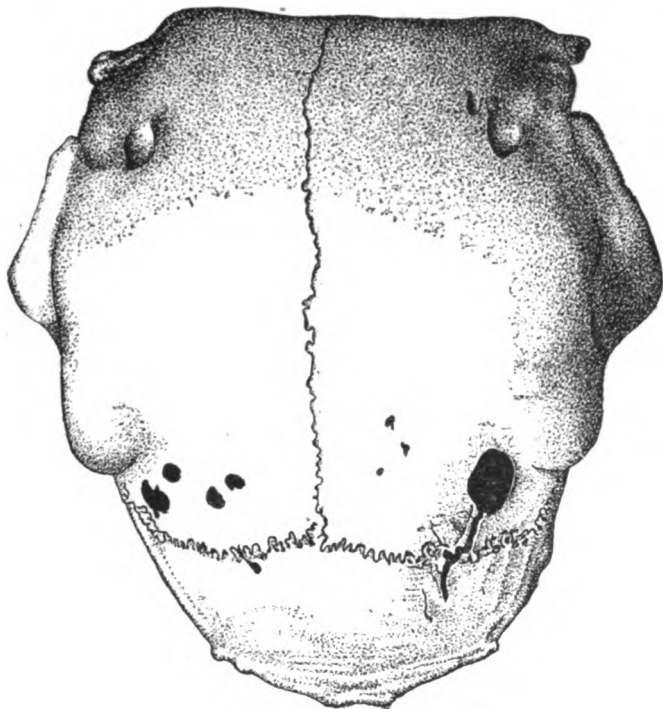


FIG. 12.—Sheep's skull, showing perforations resulting from the presence of gid bladderworms.
(After Dewitz, 1892, p. 65, fig. 47.)

intermediate, and completely separates them (Yvart). It may be situated deeply or only be beneath the arachnoid. The medullary substance is atrophied and hyperemic where it is located or it is softened. The muscles of the hind quarters are wasted and otherwise show the alterations of cachexia.

In a large number of animals there are found in various organs—and especially the heart, lungs, liver, spleen, mesentery, and muscles—some round or ovoid greenish corpuscles from 1 mm. to 4 mm. in diameter. They are composed of an enveloping membrane and granular contents rich in fat globules. These are atrophied and degenerated *Cœnures*, the remains of erratic embryos which have not met with the conditions favorable for their development. Nathusius and Eichler have seen somewhat large *Cœnures* in the subcutaneous connective tissue of the calf and sheep.

The malady having generally a chronic course there are observed more or less everywhere the lesions of pronounced cachexia.

DIAGNOSIS.

In diagnosing gid care should be taken not to confuse it with vertigo due to heat, epilepsy, blindness, false gid due to grubs in the nasal cavities, and inflammation of the intracranial sinuses. Likewise, medullary gid should not be confounded with the trembling disease (Scotch louping-ill) or lumbar prurigo.

In some respects the symptoms of gid present many similarities to those of the so-called loco disease of the Western States, and it does not seem unlikely that in some cases the two diseases have been confused. The latter disease, however, is more chronic in its course and does not present the acute symptoms of gid. It is also likely to become evident in animals too young to allow of sufficient time for the development of symptoms of gid, except in cases where early symptoms occur corresponding to the stage of invasion of the parasite. Loco disease, moreover, rarely seems to be a direct cause of death, and the condition of "loco" when once established persists indefinitely.

When gid is suspected in a flock the best means for a positive diagnosis consists in killing one of the affected animals and examining the brain and spinal canal for the presence of the bladderworm.

TREATMENT.

Treatment of gid with drugs is useless, and, on account of the location of the parasite, the various methods of operation which have been practiced are also of little practical use. Trephining and removing the parasite, cauterizing, several days refrigeration of the cranium with ice, or continuous irrigation of the skull with cold water for a period of two weeks, has resulted in a cure in some cases. An operation may be attempted in the case of an especially valuable animal, but in general the surest economy is the slaughter of the animals as soon as symptoms become evident. In case the disease is recognized during the period of invasion the animals may be fattened and killed before the final stage of the disease begins or immediately upon the appearance of the final symptoms.

PREVENTION.

Prevention of gid is, comparatively speaking, a simple matter. With our complete knowledge of the life history of the gid parasite, it is possible to prescribe certain rules which, if observed, will effectually prevent the occurrence and spread of the disease.

All superfluous dogs should be killed. It is hardly necessary to insist upon the destruction of wolves and foxes, on account of the possibility of infestation from this source, since they are already sufficiently under the ban for other reasons. A certain number of dogs are, of course, indispensable, and these animals should be treated sys-

tematically at intervals for tapeworms. While the dog is undergoing treatment he should be kept tied up and all feces collected and burned or buried in quicklime. Prior to the administration of the vermifuge, a laxative, such as castor oil, should be given to empty the bowels, and the animal then starved or fed on milk or soup until the following day.

In giving fluid medicine to a dog the cheek should be pulled away from the teeth at the angle of the mouth, the medicine poured into the pouch thus formed, and the dog's head held until he swallows the dose. If the animal is refractory a cord thrown in two half-hitches over his nose will be of assistance in holding him. After the administration of the dose the dog should be tied short enough to prevent his lowering his head and getting rid of the medicine by vomiting.

Preliminary treatment with a laxative not only serves to clear out the intestines so that the vermifuge will act more vigorously, but usually also expels fragments of tapeworms, from the number of which some idea of the degree of infection may be gained. An experienced observer will also be able to determine by study of these fragments (figs. 8, 9) the species of tapeworms to which they belong. Whether segments appear in the dog's feces or not, the practice of occasional vermifugal treatment should not be neglected. To render more certain the expulsion of all tapeworms the treatment may be repeated in two weeks or a month.

The following notes on vermifuges and their administration are taken from Stiles (1898):

In selecting a remedy it is well to consider the following drugs. The doses (apothecaries' weight) here given and the remarks on the drugs are abstracted from French (1896).

The doses of pelletierine tannate are, for adults, 5 to 15 grains; puppies, one-half to 5 grains. Pelletierine is undoubtedly the most efficient and innocuous tæniacide for the dog we possess, but is not much used on account of its expense. French has frequently found it most useful when the stomach has refused to retain other remedies. It should be administered in gelatin-capsular form in conjunction with powdered purgatives.

Aspidium is perhaps the most reliable of all the vermifuges with the exception of pelletierine. For everyday practice it is to be preferred to all other remedies when given in the form of oleoresin. Doses: For adults, 15 to 40 minims; puppies, 5 to 15 minims. The dose of the liquid extract is the same.

Kamala is a very efficient tæniacide with drastic purgative properties. Given in small amount as an adjunct to other tæniacides, particularly to the oleoresin of male fern, it will be found a very valuable remedy. Doses: Adults, 15 to 30 grains; puppies, 3 to 15 grains.

Brayera (U. S. P.), *Cusso* (B. P.), yields kosin or koussin, to which it owes its tæniacidal properties. It is one of the best and safest tæniacides, its action being directly toxic to the worm, but it is too expensive for ordinary practice. The infusion (*Infusum brayeræ*, U. S. P.) and fluid extract (*Extractum brayeræ fluidum*) are both too bulky and disagreeable for administration to dogs. Kosin may be given in capsules in doses—adults, 10 to 40 grains; puppies, 10 to 20 grains. The drug usually acts as its own cathartic, but it is better to employ some adjunct for this purpose.

Powdered *areca nut*, when freshly ground, is a very good remedy for tapeworm.

When old, it will generally be found inert; consequently, it is best always to purchase the nut and grind or grate on an ordinary nutmeg grater. It is still largely used by British veterinarians and is a favorite with some Americans, but it can not be regarded as being either as effectual or easy of administration as the two preceding drugs. Its effects on puppies are not unattended with danger, on account of its great astringency; but with due regard to subsequent purgation it is a perfectly safe remedy. Mayhew's method of prescribing 1 to 2 grains to every pound weight of the dog is usually followed, but the smaller quantity will generally suffice, provided the powder is freshly ground. It may be conveniently given in gelatin capsules, accompanied or followed by a purgative.

Turpentine is a powerful remedy against tapeworms, but it is regarded as being somewhat dangerous from its liability to produce strangury and renal inflammation. These effects are said to be less pronounced after large than after small doses, but large doses are more liable to cause gastric and enteric inflammations. It can hardly, therefore, rank with the best remedies. Administer in emulsion with white of an egg, mucilage, milk, or oil. Doses: Adults 10 to 15 minims; puppies, 3 to 10 minims.

Doctor Hoskins has had very satisfactory results with this drug in puppies under 6 months of age and has never noticed any gastric or renal results. In very young puppies he rarely gives over 2 minims, carrying it up to 10 minims and repeating for two or three days on an empty stomach in the morning, allowing no food for an hour or two after its administration.

The following suggestions as to doses, compiled from various sources, are taken from Curtice (1890):

(1) Allow 2 grains of freshly powdered areca nut for each pound of the dog's weight; administer dose in soup or milk, stirring it well, or by mixing it in butter or molasses. Follow in two hours with a tablespoonful of castor oil for a moderate-sized dog, giving the oil alone or in three times its quantity of milk.

Zürn advises 4 drams of areca nut for a large dog, 2½ drams for a medium-sized animal, and 1 dram for a small dog.^a

(2) One teaspoonful of turpentine and two tablespoonfuls of castor oil given in a cup of milk. The final dose of physic is not given in this case.

(3) Twenty drops of oil of male shield-fern, 30 drops of turpentine, and 60 drops of ether. Beat together with one egg and give to the dog in soup.

(4) Hagen advises 80 grains of oxide of copper with 40 grains each of powdered chalk and Armenian bolus. Mix with sufficient water to make an adherent mass and divide into 100 pills. Administer one pill three times daily for ten days, in meat or butter.

(5) Röhl prescribes the following dose for large dogs; smaller doses should be given in proportion to the size of the dog:

(a) Two drams each of extract of male fern and of powdered male fern; or

(b) Decoction of 2½ ounces of pomegranate-root bark in water, reduced to 6 fluid ounces, to which add 1 dram of extract of male fern. Give in two doses, at intervals of one hour; or

(c) One-half to 1 ounce of kousso, made into pills, with honey or molasses and a little meal; or

(d) From 1½ to 2½ drams of kamala, stirred with honey or water, and given in two doses inside of an hour.

[a, b, and c should be followed in two hours with castor oil, but this is not necessary for d.]

^a The doses given by Zürn are two to three times larger than those prescribed by American authorities for *freshly* powdered areca nut, and should be used cautiously.

In addition to treating dogs with vermifuges to rid them of the gid tapeworm, and thus removing the source from which sheep and cattle become infested, it is also essential that precautions be taken in turn to prevent the dogs from acquiring the parasite. This is accomplished by preventing dogs from eating those portions of the carcasses of "giddy" animals—namely, the brain and spinal cord—in which the bladderworm is located. These portions should be destroyed by burning, or rendered, or they may be thoroughly boiled, and can then be fed with safety to the dogs.

Not only is it a matter of immediate economy to slaughter animals affected with gid as soon as the symptoms indicating the final stage of the disease appear, and while they are still in good flesh, but it is also advisable from the prophylactic standpoint in that it removes a source of infestation to the dogs, and thus indirectly protects sheep and cattle from infestation, provided, of course, that the heads of the slaughtered animals are properly disposed of as suggested above.



(Concluded from page 2 of cover.)

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JUN 5 1905

U. S. DEPARTMENT OF AGRICULTURE,

BUREAU OF ANIMAL INDUSTRY—BULLETIN No. 67.

D. E. SALMON, D. V. M., CHIEF OF BUREAU.

NECROTIC STOMATITIS.

WITH SPECIAL REFERENCE TO ITS
OCCURRENCE IN

CALVES (CALF DIPHTHERIA)

AND

PIGS (SORE MOUTH).

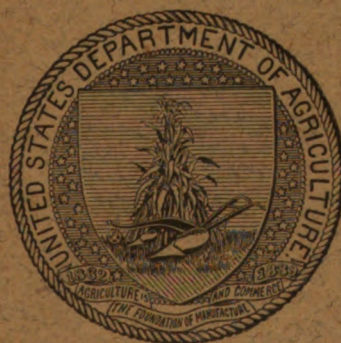
BY

JOHN R. MOHLER, A. M., V. M. D.,

Chief of Pathological Division, Bureau of Animal Industry,

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Assistant in Pathological Division, Bureau of Animal Industry.WASHINGTON:
GOVERNMENT PRINTING OFFICE.

1905.

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(Continued on page 3 of cover.)

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF ANIMAL INDUSTRY—BULLETIN No. 67.

D. E. SALMON, D. V. M., CHIEF OF BUREAU.

NECROTIC STOMATITIS.

WITH SPECIAL REFERENCE TO ITS
OCCURRENCE IN

CALVES (CALF DIPHTHERIA) AND PIGS (SORE MOUTH).

BY

JOHN R. MOHLER, A. M., V. M. D.,
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WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1905.

LETTER OF TRANSMITTAL

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF ANIMAL INDUSTRY,
Washington, D. C., February 1, 1905.

SIR: I have the honor to transmit herewith a manuscript on "Necrotic stomatitis, with special reference to its occurrence in calves (calf diphtheria) and pigs (sore mouth)," by Dr. John R. Mohler and Dr. Geo. Byron Morse, both of the Pathological Division of this Bureau.

It is definitely known that this disease has been in this country during the last three or four years, and it is probable that it has been present a much longer time. It affects calves, pigs, adult cattle, lambs, asses, kangaroos, rabbits, dogs, and chickens, but in this country it has so far been reported for calves and pigs only. The percentage of losses varies greatly, but it is always large.

I recommend that this manuscript be published as a bulletin of the Bureau series.

Respectfully,

D. E. SALMON,
Chief of Bureau.

HON. JAMES WILSON,
Secretary of Agriculture.

CONTENTS.

	Page
Introduction	9
Name and synonyms	9
Definition	10
Historical review and geographical distribution	10
Etiology	12
A. Predisposing conditions	12
B. Active agent (<i>Bacillus necrophorus</i>)	12
Bacteriology	12
Name	12
History	12
Morphology	13
Motility	13
Staining	14
Biology	15
Plate cultures	15
Shake cultures	16
Stab cultures	17
Cultures in fluid media	18
Action of germicides	18
Chemical activities	18
Pigment production	18
Odor production	18
Production of substances that liquefy	18
Indol formation	19
Production of curdling ferments	19
Production of toxins	19
Immunity	20
Occurrence in nature	20
Pathogenesis	21
Under natural conditions	21
Under artificial conditions	22
Experiments on rabbits	22
Subcutaneous method	22
Intravenous method	24
Experiments on mice	25
Subcutaneous inoculation	25
Experiments on guinea pigs	26
Experiments on chickens	26
Experiments on pigeons	26
Experiments on calves	26
Subcutaneous inoculations	26
Subcutaneous and intravenous inoculation	28
Intravenous inoculations	28
Experiments on sheep	29
Subcutaneous inoculations	29
Experiments on pigs	29
Subcutaneous inoculations	29

	Page.
Pathology	30
Symptoms	32
Course and termination.....	34
Infective character	34
Susceptibility	36
Economic importance	37
Differential diagnosis	39
Prognosis	46
Treatment	40
Prophylaxis	40
Therapeutics.....	41
Relation of animal diphtherias to man.....	42
Disposition of meat of affected carcasses	42
Conclusion	43
Bibliography	44

ILLUSTRATIONS.

	Page.
PLATE 1. Necrotic stomatitis with lesions involving tongue and cheek.....	16
2. Fig. 1.—Section of upper lip of calf showing necrosis bacilli. Fig.	
2.—Section of liver of rabbit showing a peripheral area of caseation.	16
3. Section of lung of rabbit showing metastatic foci.....	24
4. Section of lung of rabbit showing felted network of <i>Bacillus</i> <i>necrophorus</i>	24
5. Fig. 1.— <i>Bacillus necrophorus</i> from metastatic focus in rabbit's heart.	
Fig. 2.—Petri dish containing characteristic colonies of necrosis bacilli	24

NECROTIC STOMATITIS.

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INTRODUCTION.

The vestibular character of the mouth in its relation to the general organism makes any disease of the oral cavity an important matter. Mechanic, chemic, and thermic influences may each play a part in the production of various disturbances of its mucous membrane, but the most frequently operative of all causes—and most serious, too—are the microorganismal. It is these last which render any form of stomatitis serious and constitute the real source of danger in the grave forms. Not the least interesting in this last group—and, as we shall show, of considerable economic importance, although until recent years not recognized in this country—is the affection to which we have given the name “necrotic stomatitis.” Owing similar predisposing conditions and recognizing a common etiologic agent, its occurrence has been noted in calves, pigs, adult cattle, lambs, asses, kangaroos, rabbits, dogs, and chickens. In this country it has been reported up to the present time only among calves and young pigs, being probably more prevalent among the latter. For this reason and because our investigations in this disease have been limited to cases occurring in these two species only, the following pages will deal with necrotic stomatitis of calves and of pigs.

NAME AND SYNONYMS.

Necrotic stomatitis of calves has been known generally under the unfortunate term of “calf diphtheria.” Diphtheria has a specific cause (Klebs-Löffler bacillus) and a definite histologic picture, both of which are lacking in necrotic stomatitis. The name “calf diphtheria”

is therefore a misnomer. The pathologic process in necrotic stomatitis always presents the picture of a diphtheric inflammation plus caseation—that is to say, an inflammation characterized by the production of a membrane, which, as an essential feature of the disease process, undergoes cheesy degeneration. Since this progressive necrosis is caused by the necrosis bacillus, the origin of the term “necrotic stomatitis” is self-evident. This disease in calves has also been termed gangrenous stomatitis, ulcerative stomatitis, malignant stomatitis, tubercular stomatitis, diphtheric patches of the oral mucous membrane, necrosis diphtherica caseosa, stomatitis diphtherica multiplex, and stomatitis membranacea diphtherica. In pigs the affection has been designated ulcerative stomatitis, sore mouth, and canker of the mouth.

DEFINITION.

Necrotic stomatitis is an acute, specific, highly contagious inflammation of the mouth, occurring enzootically in many species of animals and characterized locally by the formation of ulcers and caseo-necrotic patches and by constitutional symptoms, chiefly toxic. The disease is in no way related to diphtheria of man.

HISTORICAL REVIEW AND GEOGRAPHICAL DISTRIBUTION.

During the last few years farmers and cattlemen of this country have noted the increasing occurrence of sore mouth among the young animals of their herds. Instead of healing of themselves, as the usual forms do, these cases, if untreated, die. Careful study of some of them has resulted in their identification with cases first reported by Dammann⁹ in 1876 from the shore of the Baltic. His model clinical investigations, making the description of the disease suitable for to-day, and his accurate postmortem findings were marred by subjection to the then dominating assertion of Eberth, “without micrococci no diphtheria.” Finding micrococci everywhere present in the diseased tissues of the mouth, and failing to recognize the fatal results in his experimental inoculations as due to septicemia, Dammann pronounced the disease identical with diphtheria in man. To what extent the malady occurred before his time it is difficult to determine, but from the fact that his clinical observations were soon confirmed by a number of contemporary veterinarians, it is probable that at the time of his writing it was not very uncommon.¹⁵ In 1878, Blažeković⁸ gave an extensive report of sixteen cases (fourteen fatal) of calf diphtheria in Slavonia, and, in 1879, Vollers,⁶⁶ adopting Dammann’s theory, recorded four cases of the same disease in Holstein. Near the close of 1880, Lenglen⁴¹ described quite accurately the local manifestation and gen-

^aThe figures refer to the bibliography at the end of this bulletin.

eral symptoms of the disease as noted by him in a series of ten cases in the northern part of France. Under the title of gangrene of the mouth in young calves, he identified the disease with gangrenous stomatitis, or noma, in children, and, as predisposing causes, associated the eruption of the teeth with bad sanitary and dietetic conditions. His article attracted the attention of MacGillivray,⁴⁶⁻⁵⁰ of Banff, Scotland, who published several articles during 1881-82, describing his experiences with the same disease, and asserting that it was a tubercular stomatitis rather than diphtheritis, or gangrenous stomatitis. During these two years there entered into the controversy thus started in the Veterinary Journal and the Veterinarian, the following persons with reports of their own cases: Campbell,⁶ Cole,⁸ Fleming,¹⁶ Gunn,²⁵ James,²⁸ Metherell,⁵¹ Smith,⁶³ and Steel.⁶⁴ In 1884, Löffler⁴⁴ isolated and described the bacillus of human diphtheria, thus destroying all previous theories as to the cause and relation of micrococci with that disease. Pursuing similar investigations, he the same year isolated from diseased tissues in cases of so-called calf diphtheria a long slender thread-like bacterium, which he described and demonstrated as the cause of this affection. Löffler thus proved diphtheria of man absolutely distinct etiologically from that disease, so called, in calves. In 1903, Mettam⁵² observed this affection in Ireland in the calves of the province of Munster and in Dublin, while McFadyean⁴⁵ has mentioned his familiarity with its prevalence for some years in various sections of England. We have no exact knowledge of the existence of the disease in this country prior to 1897, when it was recognized by one of us in southwestern Texas. It was later observed in rather serious outbreaks in 1902 and 1903 in Colorado, Wyoming, and South Dakota.

Bang,¹ in his notable work on the necrosis bacillus, was the first to announce this parasite's causative relation to the deep necroses often affecting the mouths of hogs. However, Johnne,³² in his pathological reports for 1890, seems to have recognized the disease in pigs, although it was not until 1893 that Schlegel,⁵⁹ working in conjunction with Johnne,³³ proved the relationship of the *Bacillus necrophorus* to diphtheric inflammation of the tonsils, pharynx, and larynx in hogs. Kitt³⁵ was also able to recover the causative agent of this disease from the diphtheric lesions of the larynx and pharynx of calves and pigs in 1893. In 1903, Lauritsen⁴⁰ described a necrotic inflammation of the mouth in young pigs, believing, though not demonstrating, *Bacillus necrophorus* to be the cause.

The outbreaks of this disease in pigs, which we were enabled to study, appeared in an enzootic form in western Tennessee, and, at the Athenia quarantine station, among a herd of young Berkshire hogs recently imported, from which cases the *Bacillus necrophorus* was recovered.

ETIOLOGY.

Necrotic stomatitis is due to a specific infection. It is an inoculation disease and occurs as a result of the already abraded lining membrane of some part of the oral cavity being invaded by the *Bacillus necrophorus*.

A.—PREDISPOSING CONDITIONS.

These prepare the nidus for the active agent. The necrosis bacillus will not develop on a normal mucous membrane; its invasion is always secondary. Opportunity for infection of the mouth is afforded by a catarrhal inflammation of its lining, by a break in the integrity of its protective covering, or by the rôle played by the bacterial flora of the mouth in damaging its cells and tissues. Here may be mentioned, also, irritant foods, rough forage, very hot or very cold drinking water, chronic and debilitating diseases, and damp, unsanitary pens. Furthermore, as will be pointed out later, some predisposition appears necessary for the development of necrotic stomatitis. In part, this is individual, for whereas the disease is distinctly one of young animals, some of these are more highly susceptible than others.

B.—ACTIVE AGENT (*BACILLUS NECROPHORUS*).BACTERIOLOGY.^a

NAME.

This organism has been variously known as *Bacillus der Kälberdiphtherie* (Löffler),⁴² 1884; *Bacillus diphtheriæ vitulorum* (Löffler)¹⁸; *Bacillus necrophorus* (Flügge),¹⁸ 1886; *Bacillus filiformis* (Schütz),⁶¹ 1887; *Nekrosebacillus* (Bang),¹ 1890; *Streptothrix cuniculi* (Schmorl),⁶⁰ 1891; *Actinomyces cuniculi* (Gasperini),²² 1892; *Bacillus necroseus* (Salomonsen),⁵⁸ 1894; *Bacillus des Kälbernomma* (Ritter),⁵⁷ 1895; and *Streptothrix necrophora* (Kitt),³⁴ 1899.

Until authors are more agreed as to the possession by this organism of the character of branching, a feature not observed during the course of our investigations, it will be well to consider it as belonging to the Bacteriaceæ and allow priority to designate it *Bacillus necrophorus* (Flügge).

HISTORY.

First observed by Koch,³⁶ it was not isolated and described until Löffler, in 1884, demonstrated it as the cause of the disease erroneously called by Dammann^b calf diphtheria. It remained for Bang to recog-

^a It is with pleasure that we acknowledge our indebtedness to Dr. B. Bang and Dr. W. Ernst for sending us cultures of *Bacillus necrophorus* with which to compare our organism.

^b Without doubt Dammann, on page 12 of his article, in his description of the tangled network of fibrin threads in the deeper layers of the pseudomembranous deposits, really refers to the filaments of *Bacillus necrophorus*.

nize its varied activities in the production of coagulation necrosis and describe it as the *Nekrosebacillus*. A year later Schmorl made public his careful investigations of a spontaneous rabbit disease in his laboratory, resulting in the recovery of this same organism which he, either not knowing of Löffler's and Bang's labors or failing to identify his organism with theirs, called *Streptothrix cuniculi*. Since then numerous investigators have confirmed the work of the foregoing scientists and demonstrated a still wider sphere of pathogenic relationship, the latest being the proof furnished by this laboratory of the etiologic connection of *Bacillus necrophorus* with foot-rot in sheep. The morphologic and biologic characters have been quite thoroughly worked out by Bang, Schmorl, and Ernst.

MORPHOLOGY.

Bacillus necrophorus is essentially a pleomorphic organism. It varies, according to nutrient soil and age of culture, from coccoid forms to filaments over 100μ in length and from 0.75 to 1.5μ in width. The longer forms appear as slender, undulating, beaded filaments. Generally, in the tissues these threads are matted together into an intricate network, like a mass of hair or even the more compact felt. The same appearance may be found in colonies. Frequently the filamentous forms present one wide or clubbed extremity, with the other extremity tapering. On the other hand, the older cultures—either animal tissues or artificial media—exhibit almost exclusively bacillary forms of various lengths, some so short as to be easily mistaken for cocci. Involution forms may be present in any culture, but certain media, notably that composed of a mixture of agar, gelatin, bouillon, peptone, and salt are particularly favorable to their development.

Motility.—Motion has not been observed in our experiments; in fact, it has been reported by Schmorl only. He examined the pleural exudate in hanging drop. He says:

The shorter bacillus-shaped forms are mostly motile; they travel slowly through the visual field with a serpentine, or crawling, motion, but generally come very quickly to rest. The longer threads are for the most part absolutely motionless; only in the entirely detached forms does one notice pendulous movements being slowly executed. The signs of motility can be demonstrated only when the material for observation has been taken from an animal just killed or just dead. If it has been dead a longer time, one finds rods and threads altogether in the resting condition, from which they can sometimes be aroused by making the observation on a warm stage in a vacuum. Most of the rather thin and pale threads possess a characteristically stiff appearance. They float along sometimes completely extended; at other times they exhibit slight winding motion. But very seldom does one find specimens which appear spirally twisted.

Over against this statement of Schmorl may be placed that of Ernst:¹⁴

The merely feeble, oscillating, molecular movements of the rods and the pendulous, serpentine movement of long, undulating threads in changes of position, according to

the law of gravity, permit no positive decision as to motility. In order to examine the bacteria as to their motility I employed cultures; and since young, 36-hour, cultures in the hanging drop showed no active change of place beside the ordinary molecular motion, and furthermore, since in the employment of material from cultures whose growth was just becoming visible 24-36 hours, flagella were not demonstrated by mordants which gave good results in control experiments with edema and cadaver bacilli as well as colon forms, a denial of motility would appear perfectly just.

In this laboratory the examination for motility was made with fresh cultures and with tissue from animals within one hour after death, both by means of hanging drop and by the application of flagella stains. In no case was it possible to claim motion for these bacilli.

Staining.—The necrosis bacillus stains readily with the ordinary aniline dyes, Löffler's methylene blue, and Ziehl's carbol-fuchsin, producing particularly good effects. Alkaline toluidine blue (1 per cent solution), while not giving the brilliant effects of fuchsin, makes perhaps the best reagent for routine use. The slide, or cover slip, dipped in the stain, immediately washed in water and mounted, is a very rapid and satisfactory method of bringing out the beaded appearance of the organism.

In the study of fresh tissue smears, it is usually sufficient to make a film on a slide with a teased particle of the suspected tissue, and, after the usual preliminaries, stain with one of the ordinary dyes mentioned, preferably methylene blue or toluidine blue. Whenever it was desired to employ differential staining, we found the following procedure to answer all requirements: The stains are kept ready for use in wide-mouthed bottles. Prepare the film on the slide in the usual manner, fix in the flame, dip it from two to five seconds in a 1 per cent alkaline toluidine blue, wash it thoroughly in water, counterstain it in a 0.2 per cent Neisser's Vesuvian brown, wash it in water, dry, and then mount it in balsam.

An excellent method of double staining was devised for *Bacillus necrophorus* by Bang. Bits of the necrosed tissue were hardened in Müller's fluid, thoroughly washed, and further hardened in alcohol. (Alcohol alone he did not find suitable.) The sections are placed a few minutes in toluidin-safranin (produced like aniline-gentian violet), dehydrated by means of an alcoholic solution of safranin; after this, fluorescein clove oil, pure clove oil, alcohol, watery methyl green, alcohol, xylene, balsam. The bacilli are stained a beautiful red, while the tissue is stained green; no other investigated bacteria can stain in this manner.

Mention has been made of the beaded appearance of the *Bacillus necrophorus* in stained preparations. This is noticeable equally in tissue smears or sections and in films from cultures. The longer rods and threads particularly exhibit this characteristic. It is due to the occurrence in the filaments of unstained spaces which were at first thought to be spores. Spore-staining methods, however, do not alter them.

Careful study of this peculiarity reveals several phases of it. Sometimes a thread will be most regularly marked off into alternate sections of stained and unstained material; again, decided irregularity characterizes the arrangement—long vacuole-like inclusions alternating with shorter stained squares or bacillus-like spaces of stained material may alternate with shorter colorless portions; again, the vacuoles may appear like a chain of colorless rods lying on a ribbon of blue or whatever color may be used for the stain. Sometimes the stained material is so little in quantity that the thread seems like a string of spores, oval or rod shaped, with thin, deeply stained partitions between them. On the other hand, the filament presents itself as an unstained tube with a regular succession of deeply stained coccus-like granules much resembling streptococci, or these granules may be alternately arranged along the sides of the tube.

BIOLOGY.

Cultivation of the *Bacillus necrophorus* is not easy. It is an absolute anaerobe. Investigators differ concerning its requirements as to temperature. Nocard and Leclainche⁵³ give 30° to 40° C. as the limits of growth, with the optimum at 37° C.; Jensen adopts the same extremes, but places the optimum at 34° C.; whereas, according to Ernst, development occurs only between 36° and 40° C., and the optimum is 39°. Our own investigations have shown that 30° to 40° C. represent the extremes of temperature at which the ordinary work of the laboratory may be satisfactorily carried on; nevertheless, we have on different occasions been able at 28° C. to grow in agar-bouillon shakes typical colonies, which responded to the usual tests of morphology, odor, and pathogenesis. With us the optimum was 35° C.

The usual culture media of the laboratory are either unsatisfactory or altogether inimical to the development of the necrosis bacillus. Agar-agar was often employed with only passable results, but more satisfaction was obtained from the following combinations: Agar-bouillon (A-B); agar-gelatin (A-G); serum-agar (S-A); serum-agar-gelatin (S-A-G); and two suggested by Ernst—1.5 per cent agar in a peptone-salt-bouillon (A-B-P-S) and 0.7 per cent agar and 7 per cent gelatin in bouillon with 5 per cent peptone and 2.5 per cent salt (A-G-B-P-S). The first four mixtures were usually prepared in the proportions of equal parts, although other proportions were adopted for the purpose of varying the consistence of the medium. Fluid blood serum, milk, rabbit bouillon, and Martin's bouillon were also employed.

PLATE CULTURES.

Bouillon agar.—Great difficulty was experienced in getting the organism to develop colonies in Petri dishes. Numerous attempts were made by displacing air with hydrogen in a hydrogen jar, and by

the formation of a vacuum by withdrawing the air under a bell jar by means of a vacuum pump, but success was not attained in any instance. Recently it was endeavored to grow the organism in Petri dishes placed in a closed jar containing a solution of pyrogallic acid rendered alkaline by sodium hydrate. This method, which permitted the presence of only the inert nitrogen gas, finally resulted in characteristic colonies occurring throughout the medium with the formation of numerous gas bubbles. Several of these colonies in the dish of the second dilution (pl. 5, fig. 2) grew so close to the surface that some filaments extended to the upper stratum, and could be removed by means of a platinum needle. In about forty-eight hours after exposing the plates to this method, small, pinhead-sized, dirty-white, opaque, round colonies, possessing no distinctive features, were visible to the unaided eye below the surface. Many small round or oval gas bubbles could also be observed. By means of a small magnifying glass these colonies were seen to possess a yellowish-brown center surrounded by a thin, light, almost translucent border, which, under the microscope, appeared floccose. After three days the colony presented to the naked eye a woolly appearance, and the microscope now revealed the central structure as a felted maze of threads and the floccose character of the border as long, wavy filaments.

SHAKE CULTURES.

Agar-bouillon.—In eighteen to twenty-four hours after inoculating a tube either from necrosed tissue or from a colony in another tube, or with a loopful from the depths of a pure Martin's bouillon culture.

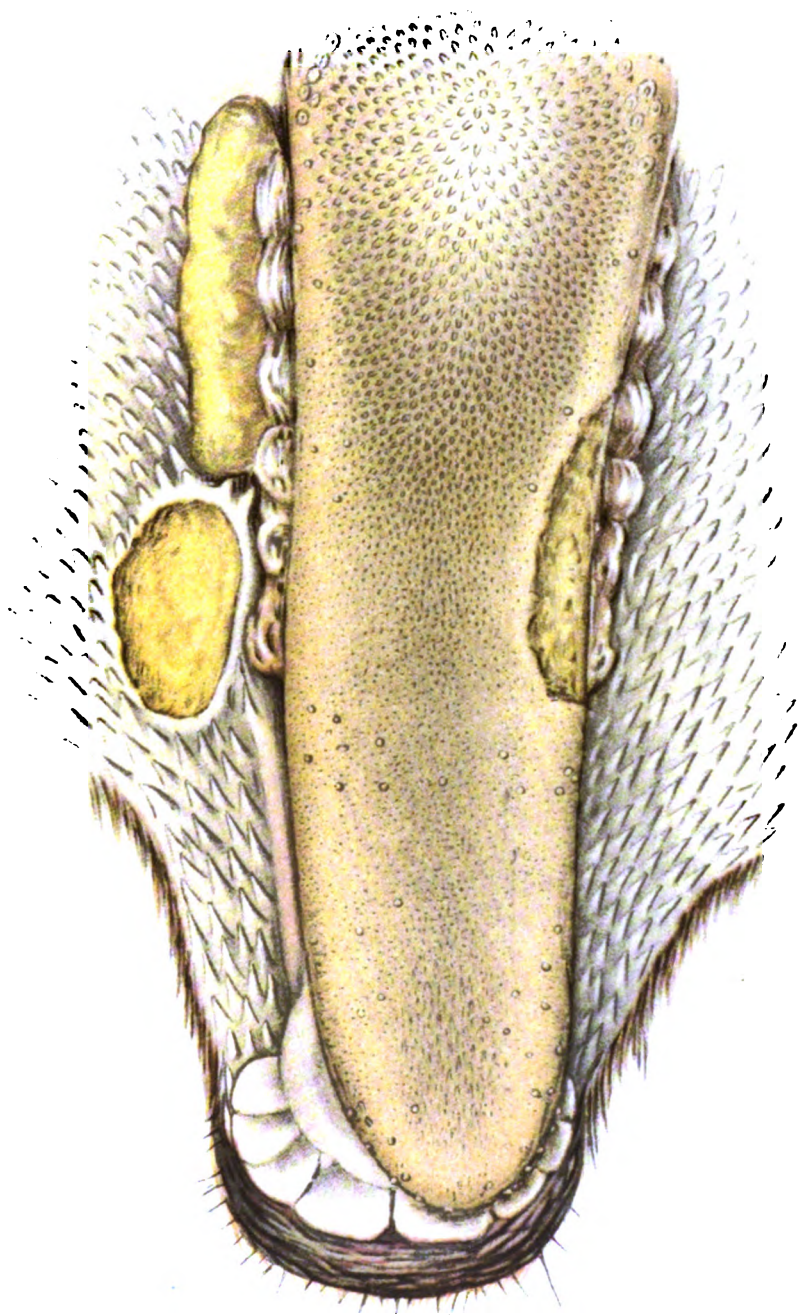
DESCRIPTION OF PLATE 1.

Tongue and cheek of calf showing lesions of necrotic stomatitis as a result of natural infection. Notice the zone of thickened granulated tissue surrounding the dry, cheesy, grayish-yellow areas of necrosis both in the tongue and cheek.

DESCRIPTION OF PLATE 2.

FIG. 1.—Section of the upper lip showing the necrosis bacilli in their special rôle of producing a deeply penetrating necrosis. The cuticular layer has suffered complete coagulation necrosis and caseation. The drawing depicts the bacilli in the act of carrying the necrosis down between the papillæ. Lodged in the interpapillary epithelium they have completely destroyed the portion where they lie and have exerted their toxic influence on the cells to the left. To the right is a section of a papilla whose suprapapillary layer of epithelium has been destroyed next the bacillary mass preparatory to the attack on the connective tissue framework of the papilla. Stained with methylene blue and eosin. Magnified about 640 diameters.

FIG. 2.—Section of liver of rabbit No. 1183, inoculated with an emulsion of necrosed tissue obtained from rabbit No. 1166, which had been inoculated with material from a pig affected with necrotic stomatitis. The peripheral area of caseation delimited by the well-defined line of demarcation is the result of the extension of the necrosis by contiguity of structure as the abdominal wall at this point was adherent to the capsule of Glisson by a plastic exudate. No other areas of necrosis were observed in the liver. Stained by hematoxylin and eosin, and magnified about 22 diameters.



NECROTIC STOMATITIS WITH LESIONS INVOLVING TONGUE AND CHEEK.

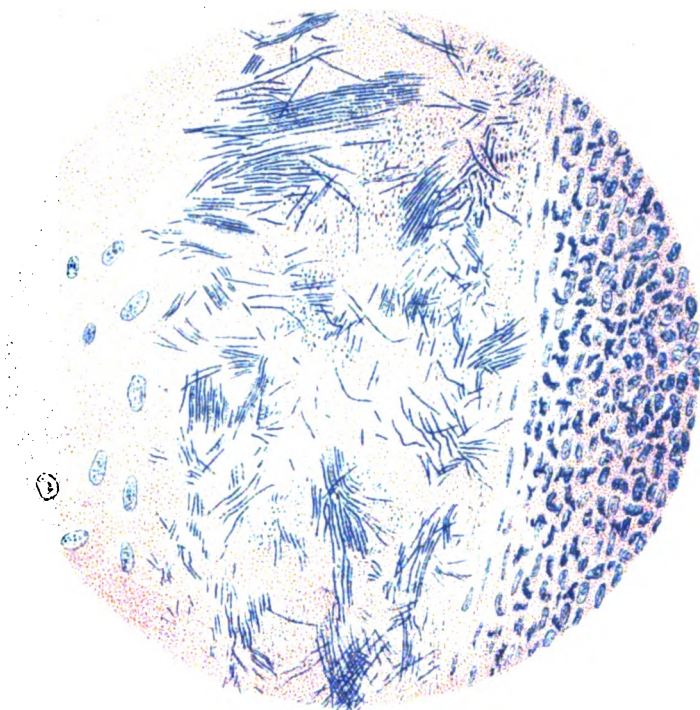


FIG. 1.—SECTION OF UPPER LIP OF CALF SHOWING NECROSIS BACILLI.



FIG. 2.—SECTION OF LIVER OF RABBIT SHOWING A PERIPHERAL AREA OF CASEATION.

the tube is studded with small oval gas bubbles. At this time, also, rarely with the A-B medium, frequently with the softer forms, as S-A-G, A-G (2:1), A-B-P-S, and A-G-B-P-S, the column of culture medium will be transversely ruptured in one, two, or more places by the pressure of the gas. In forty-eight hours these sections will often be separated 2 to 5 mm. and even more from each other. We have sometimes seen this gas formation go on for the next two days, sufficiently strong to raise the upper portion of the medium 2 cm. The dilution from the above-described tube—tube 2—would often follow tube 1 quite closely in the quantity of gas bubbles formed, though not in the breaking up of the medium. Tubes 3 and 4 would usually show a great diminution in the quantity of gas bubbles and no breaking up of the medium.

In the development of the growth, our experience tallied quite closely in a few notable points with that of Ernst. For instance, shakes sown with necrosed material would often show, after thirty-six to forty-eight hours, a fine grayish white mist of cloudiness at the lower portion of the tube. In our experience, even with slight magnification, it was possible to detect no particular structure. A film made from this portion of the culture medium would always show beaded forms. Again, when the medium used was jelly-like in consistence, the unabsorbed gas, instead of remaining as bubbles at the point formed, would gradually float upward toward the surface. The original seat of these bubbles and the pathways along which they had risen would be coated with a fine bacterial growth. Thus would be formed numerous filmy ribbons, extending from near the surface down into the depths of the tube, where they would be anchored by a crescent-shaped body. The time and rate of growth and appearance of colonies in the tube are sufficiently described in the description of the plates.

STAB CULTURES.

Agar-agar.—Near the close of the second day a few grayish-white colonies make their appearance at the bottom of the needle track. Gradually these increase from below upward to within 1-1.5 cm. of the top of the stab canal. Thus is formed a thin, narrow, opaque, yellowish or grayish white line of growth surrounded by a thin whitish cloud, which on slight magnification is seen to be composed of minute wavy threads.

Along the needle track, and, if the medium is not too hard when inoculated, throughout the culture may be seen numerous round and oval gas bubbles.

Serum-agar.—Time and height of bacterial growth and gas formation are like the preceding. At times the needle track is the center of a whitish film or merely a thin line of cloudiness of the medium;

again, the growth may be denser, similar to that described for agar-agar. The serum is never liquefied, although in very old cultures it will be natural that the zone of cloudiness referred to has spread nearly to the walls of the tube.

CULTURES IN FLUID MEDIA.

Bouillon.—The organism can be grown in ordinary peptonized beef broth, rabbit bouillon, and in Martin's broth, the maximum development occurring at the temperature of 35° C. in a hydrogen jar. The bouillon becomes turbid with the formation of some gas which is noticeable by the surface bubbles. Later the bacillary masses sink to the bottom in the form of whitish viscid flakes, causing the fluid to become clearer. The cultures have a peculiar odor, very characteristic, which will be referred to later. There is no film formation, but a tendency to develop a ring around the border of the medium has been observed. (See "Milk" and "Fluid serum," on next page.)

ACTION OF GERMICIDES.

In determining the germicidal power of disinfectants a measured volume of a forty-eight-hour bouillon culture of the necrosis bacillus was intimately mixed with an equal volume of the disinfecting solution, thereby reducing the strength of the germicide to one-half. Three platinum-wire loopfuls were then transferred to fresh rabbit bouillon tubes after varying periods of exposure. After an exposure of 1 minute in a 2 per cent solution of carbolic acid the bouillon tubes showed growth, but in the tube representing a two-minute exposure no development occurred. With bichloride of mercury an exposure of nine minutes to a $\frac{1}{1000}$ solution prevented growth. Formalin in the strength of $2\frac{1}{2}$ per cent solution (1 per cent formaldehyde) killed the organism in thirteen minutes.

CHEMICAL ACTIVITIES.

PIGMENT PRODUCTION.

Chromogenesis is wanting.

ODOR PRODUCTION.

All cultures develop a substance or substances which evolve an odor well described by Ernst as between the odor of cheese and that of glue. The stench is so characteristic that the presence of the bacillus is recognized at once in the tissues of either natural or experimental infection as well as in cultures on artificial media.

PRODUCTION OF SUBSTANCES THAT LIQUEFY.

Gelatin is not liquefied. The growth of the bacillus is likewise without effect on hardened blood serum.

INDOL FORMATION.

Indol is formed and may be demonstrated in three-days-old cultures made in Martin's bouillon.

PRODUCTION OF CURDLING FERMENTS.

Milk is not coagulated nor is acid produced. Fluid serum is coagulated.

PRODUCTION OF TOXINS.

That the necrosis bacillus produces a toxin is evidenced, not by the isolation of the same from artificial cultures, but by (1) the character of death in the disease, (2) the quality of the rigor mortis, and (3) the study of the pathologic histology.

The toxic character of death is not particularly noticed in animals suffering from stomatitis when inappetency and inability to take nourishment have produced an enfeebled condition. Nor, again, is it noticeable in those animals which die with embolic foci in liver or lungs, the symptoms arising from the diseased organs often masking the signs of intoxication. However, rabbits inoculated subcutaneously in the back will persist, without any other sign of the disease except the abscess, for about five or six days. Suddenly, on the sixth or seventh day, without any premonitory signs, the rabbit will be thrown into convulsions, coming out of one to lie with its head turned sideways and buried in the bottom of the cage until another attack, dying usually in a few hours after the first convulsion. Quite often in these cases the local lesions will not be sufficient to directly produce death, not being very extensive, and not involving any important organ. Such a course as this points unmistakably to a toxinemia which has attacked the nervous system.

The limits of this article do not permit a discussion of the factors entering into the production of cadaveric rigidity. For our present purpose it is sufficient to call attention to the fact that the intensity and long duration of the rigor mortis observed in the experiment animals and described later in this paper comports perfectly with the well-known fact that the presence of toxins in the blood promotes muscular rigidity.

It may be stated with positiveness that *Bacillus necrophorus* does not enter an unimpaired tissue. Most, if not all, of its infections with which we are acquainted require for their inception a break in the continuity either of mucous membrane or skin. A histologic study of an affected area, elsewhere examined in greater detail, reveals a center of completely destroyed tissue marked by an entire absence of the specific bacteria in question. The boundary of this dead area is formed by great bundles of filaments of *Bacillus necrophorus*, large numbers of leucocytes, and a fair sprinkling of tissue cells whose nuclei still

respond to stains. The immediately adjoining border of surrounding healthy tissue is seen when carefully examined to possess numerous cells whose protoplasm has been more or less destroyed, and in among these dying cells a few scattered filaments have advanced like skirmishing parties before the main army. It is a true picture of a bacillary invasion of tissue begun by means of the noxious effects of a soluble toxin.

Thus far all attempts to recover the toxic substance either from cultures or the bacilli themselves have failed. From this, Jensen,²¹ whose assistant, L. Bahr, has made the only experiments thus far recorded, assumes that either the necrosis bacillus forms these substances only in the living animal or they are of such volatile character that they are destroyed as quickly as they are formed.

IMMUNITY.

The literature of *Bacillus necrophorus* has contained no word on acquired immunity until the article by C. O. Jensen²¹ referred to above. This eminent investigator and early worker with the necrosis bacillus states that his assistant, Bahr, has demonstrated by experiments not yet published that intravenous injections of cultures of the *Bacillus necrophorus* carefully given to goats protect them from quite large quantities of the same given subcutaneously. Jensen further states that Bahr has produced in the same manner an immunity in guinea pigs from intraperitoneal injections. In view of the fact that most investigators pronounce the guinea pig almost if not quite absolutely immune, the statement needs further elucidation. On the contrary, while we are not willing yet to build any hypothesis upon it, we find that our reinoculation experiments have given us the impression that susceptibility is increased thereby rather than diminished.

OCCURRENCE IN NATURE.

There is hardly room to doubt that the *Bacillus necrophorus* is a normal inhabitant of the healthy intestine of at least one species of our domestic animals—hogs—and possibly of the cow and horse. It is also found in the manure, and therefore in soil contaminated with the latter. Bang's² discovery of the association of the organism with the necrotic processes in the intestine in hog cholera, and also as cause of an intestinal diphtheritis in calves secondary to an intestinal catarrh¹ seemed to require the intestine as the normal habitat of the necrosis bacillus. Could this be demonstrated we should then have an explanation of the remarkably ubiquitous character of the organism as exhibited in the wide diversity of diseases caused by it. In this manner could be explained its relation not only to the necrotic inflammations occurring in the vagina and uterus, but also to all the external necrotic processes. This Bang succeeded in doing. He twice made inocula-

tions of the intestinal contents of healthy hogs with the result of demonstrating the presence of *Bacillus necrophorus*. An analogous investigation by him of the intestinal canal of a cow was not so successful.

PATHOGENESIS.

Very few organisms exhibit a wider range of pathogenesis. According to clinical observation the necrosis bacillus has so far been found pathogenic for cattle, sheep, goats, antelope, reindeer, red deer, roe deer, horses, asses, hogs, kangaroos, rabbits, dogs, and chickens. Experimental work adds to the foregoing list mice and, under special conditions, guinea pigs and pigeons.

It is probably safe to assert that no tissue of the body of a susceptible animal is safe from its destructive influence.

UNDER NATURAL CONDITIONS.

Natural infections induced by *Bacillus necrophorus* may be considered as follows: Necroses of the skin, hoof, muscle, cartilage, mucous membranes (mouth and upper air passages, digestive tract, genital tract), navel, and viscera.

Necrosis of the skin in horses has occurred enzootically on a large breeding farm, the necrosis appearing on portions of the skin exposed to pressure of the harness. A necrotic form of scratches has also been shown to be a local infection of *Bacillus necrophorus*. Gangrenous pocks in cows have the same origin, and consist of an acute necrotic inflammation of the skin and soft parts of the teats. In hogs such a necrotic process has occurred in the skin of the muzzle, of the outside of the lips, of the feet, and, in sows, of the udder.

Necroses of the hoof include in horses a progressive necrosis of the soft parts of the hoof, often involving the bones and cartilages; in cows, reindeer, and roe deer, panaritium, or so-called foot-rot, involving tendon sheaths, tendons, bones, and joints; in sheep, foot-rot, recently shown to be due to the necrosis bacillus.

Necroses of muscle have been reported in connection with a granulating wound of the inner side of the hind leg of a cow, also as a result of the passage of a foreign body from the stomach into the heart muscle, and also in a case where a cow's heart, kidney, and some of the voluntary muscles were affected.

Necroses of cartilage are represented by those already included under hoof necrosis, by quittor, or fistula of the lateral cartilages, and by the laryngeal cartilages in many cases of necrotic stomatitis.

Necroses of bone have been reported in association with the hoof necrosis of various animals, in the vertebræ in the course of some cases of necrotic stomatitis, and in the turbinated bone of the horse.

Necroses of mucous membranes may be regarded as quite frequent. Those of the mouth and upper air passages are fully discussed in this

paper, and have been recognized in the calf, adult cattle, pigs, sheep, kangaroos, rabbits, asses, dogs, and chickens. No less sensitive are the mucous membranes of the digestive tract. In pigs the upper portion of the esophagus, by extension from the mouth, and in calves the esophagus in its entire length, have been affected. In hogs these "necrophorus" patches have been found in the stomach, small intestine, cecum, colon, and rectum. In horses they have been demonstrated in the colon; in cattle, in the rumen, in the reticulum, and in the small intestine; and in the deer and antelope, in the stomach.

The mucous membranes of the genital tract of cows that have recently calved are often invaded by the *Bacillus necrophorus*, resulting in a necrotic vaginitis and a necrotic metritis.

Navel disease in calves and lambs⁶⁶ is dependent in a considerable number of cases on infection of the wound by the necrosis bacillus.

Bacillary necrosis of the heart, lungs, liver, kidney, and spleen, also of the udder, have all been reported as the result of metastasis from the original seat of the disease, in necrotic stomatitis, necrotic scratches, the various forms of foot-rot, and infection of the genital passage.

The classic example of *Bacillus necrophorus* in mixed infections is hog cholera. Here it has been proved unequivocally that the deep necroses and so-called diphtheric processes occurring in the body of a pig affected with hog cholera are due in some cases to the invasion of the necrosis bacillus. It has also been found as a secondary invader in the necrotic patches in so-called fowl diphtheria.

UNDER ARTIFICIAL CONDITIONS.

The pathogenicity of *Bacillus necrophorus* under artificial conditions was tested upon rabbits, mice, guinea pigs, chickens, pigeons, calves, sheep, and pigs, in order to establish its causal relation to the disease in question.

EXPERIMENTS ON RABBITS.

Subcutaneous method.—These animals are highly susceptible to the action of the *Bacillus necrophorus*, and to this susceptibility is due the ease with which the presence of the germ in diseased tissue may be demonstrated. A bit of tissue adjacent to the border of the necrosed area is emulsified in a normal saline solution. The subcutaneous inoculation of a rabbit with 0.5 c. c. of this emulsion will result in the death of the animal within one week. In order to free the tissues of the experiment animal from other forms of microorganisms naturally present in material taken from such an exposed place as the mouth, it is advisable to use a second or even a third rabbit. The first rabbit will, however, in spite of the contaminated material used in its inoculation, show very characteristic lesions,

which can be referred to the action of no organism other than the bacillus of necrosis. The chief of these typical changes will be noted at the point of inoculation, where, lying beneath the skin and extending down for a greater or less depth into the muscular tissues, is found an irregular area about 3 to 5 cm. in diameter. This area offers to the naked eye much the appearance of a flattened mass of soft, fresh putty, and to the nose the penetrating odor already referred to as between the smell of cheese and that of glue. This pulpy, yellowish white, malodorous mass is the detritus of muscular, fatty, and vascular tissues which have been attacked and destroyed through the presence of the necrosis bacillus as well as by its effective poisons. Reaching out into the surrounding tissues for about 4 cm. in all directions is found a zone of inflammatory tissue, and the subcutaneous and muscular tissues of the abdominal region are inflamed and edematous through extension by gravitation of the disease process from the local lesion caused by inoculation. Not seldom in these cases is there to be observed a marked development of gas bubbles. Frequently that portion of the large colon adjacent to the diseased abdominal wall is greatly injected and adherent to the parietal peritoneum by a plastic exudate containing numerous short and long forms of the bacillus of necrosis. This part of the peritoneum is also inflamed and presents petechial hemorrhages. Examination of the soft mass found in the necrosed area at the point of inoculation shows that it is penetrated in every direction by long thread-like bacilli, and the subcutaneous inoculation of a second rabbit with a small scraping from this mass serves to eliminate a large proportion of the contaminating organisms. Because of the greater purity of the material now used, the inoculation will not result fatally until a period usually from eight to fourteen days, although occasionally death has been prolonged until nineteen, and in one case twenty-three, days. In many instances it will be found that this longer period of time has proved sufficient to allow the circulation to take up a few of the bacilli and deposit them in the plexuses of the lungs, liver, or kidneys, where small, yellowish white spots of necrosis will result, which may be readily peeled out as if in a capsule. From these secondary visceral necroses, pure cultures of the *Bacillus necrophorus* may now be obtained, and its further development secured by the utilization of anaerobic methods of culture. The injection of 0.5 c. c. of these pure cultures under the skin of the back produced the same characteristic yellowish white area of muscular necrosis about the point of inoculation and the peculiar penetrating odor so constant with this bacillus. The course of the disease is about the same as when an emulsion of the fresh tissue has been injected, and, in those cases in which life was prolonged several weeks, metastatic areas of focal necrosis were always noted. The approach of death is usually indicated by convulsions; the animal

comes out of one to be seized with another, death generally resulting in a few hours after the onset of the first convulsion. In the majority of rabbits that succumbed to this disease, a marked rigor mortis was observed, especially noticeable in the hind quarters, causing the back to be arched and the legs contracted as if in a tetanic spasm. Microscopic examination of tissue taken from the necrosed area or from metastatic lesions of the liver or lungs shows the presence of typical necrosis bacilli in great numbers. In the case of organic lesions these filaments are seen to be arranged along the border of the area of necrosis, whereas the central portion is amorphous and does not reveal the presence of any microorganisms.

Intravenous method.—The intravenous method of inoculation was adopted in nine cases, four of which resulted in the death of the animal. Each rabbit received in the posterior auricular vein 0.3 c. c. of an emulsion of the tissue filtered through cotton, the filtrate containing numerous bacilli.

The course of the disease ranged from seven to twelve days. The symptoms exhibited in all cases were the same as those induced by subcutaneous inoculation and consisted of gradual emaciation followed by the loss of appetite and by convulsions, paralysis, and death. The postmortem examination showed the principal lesions to be located in the thoracic cavity. The lungs contained several caseous nodules the size of peas surrounded by a hemorrhagic zone, and in one rabbit the left principal lobe was adherent to the costal pleura by a thick, purulent exudate. In each case the costal pleura contained several metastatic foci and the chest muscles in two instances were the seat of

DESCRIPTION OF PLATE 3.

Section of lung of rabbit No. 1197, inoculated subcutaneously with a bouillon culture of *Bacillus necrophorus*, showing four metastatic foci. Stained with Löffler's methylene blue. Magnified about 25 diameters.

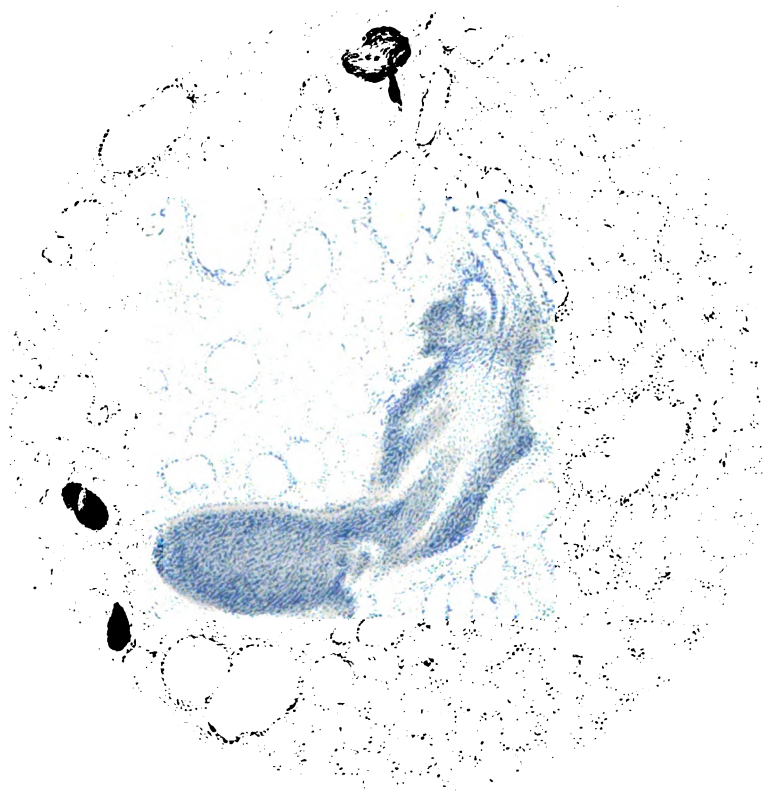
DESCRIPTION OF PLATE 4.

Section of lung of rabbit No. 1197, showing the superior focus in plate 3 greatly amplified. Notice the felted network of wavy filaments and smaller forms of *Bacillus necrophorus*. Stained with Löffler's methylene blue. Magnified about 450 diameters.

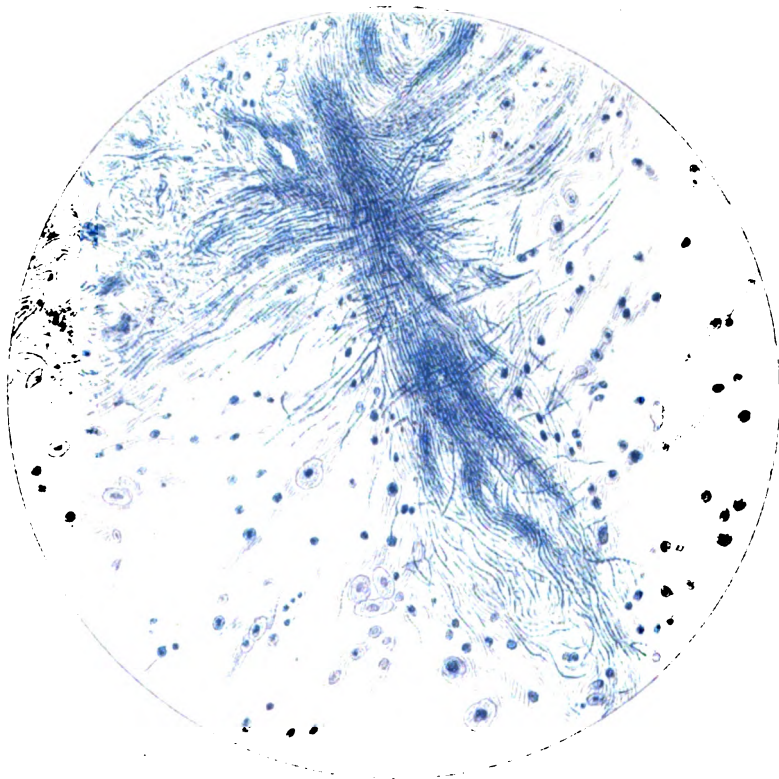
DESCRIPTION OF PLATE 5.

FIG. 1.—Cover-glass preparation from a metastatic focus in the wall of the left ventricle of rabbit No. 1219, which died on the fourteenth day following a subcutaneous injection of a Martin's bouillon culture of the necrosis bacillus. Stained with Ziehl's carbol-fuchsin. Composite drawing made with camera lucida at base of stand with Zeiss No. 6 compensating ocular, 2 mm. oil immersion objective and 160 mm. tube length.

FIG. 2.—Photograph of Petri dish containing numerous characteristic colonies of necrosis bacilli forty-eight hours after their inoculation into bouillon agar and following their incubation at 39° C. in a closed jar containing pyrogallie acid. Notice the gas formation and the fluffy outlines of the colonies, with their dark dense centers.



SECTION OF LUNG OF RABBIT SHOWING METASTATIC FOCI.



SECTION OF LUNG OF RABBIT SHOWING FELTED NETWORK OF *BACILLUS NECROPHORUS*.

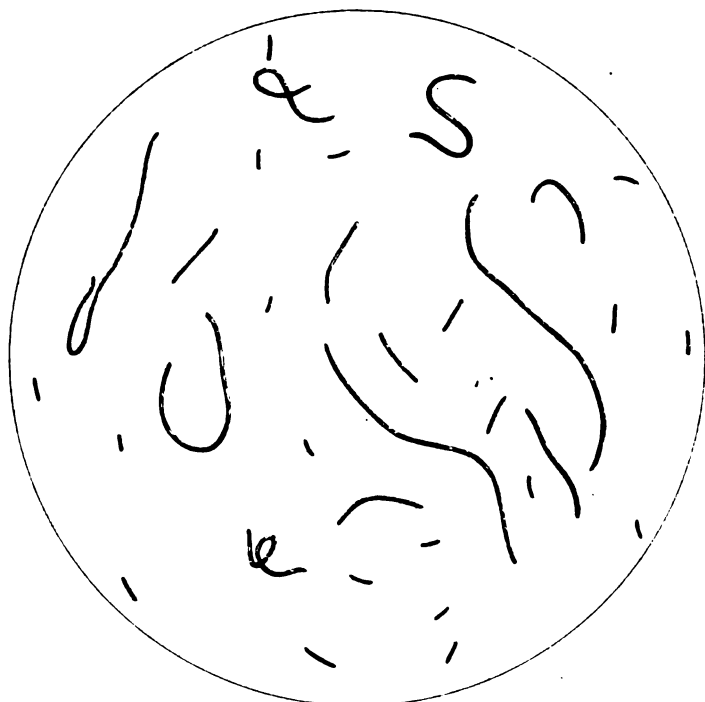


FIG. 1.—*BACILLUS NECROPHORUS* FROM METASTATIC FOCUS IN RABBIT'S HEART.

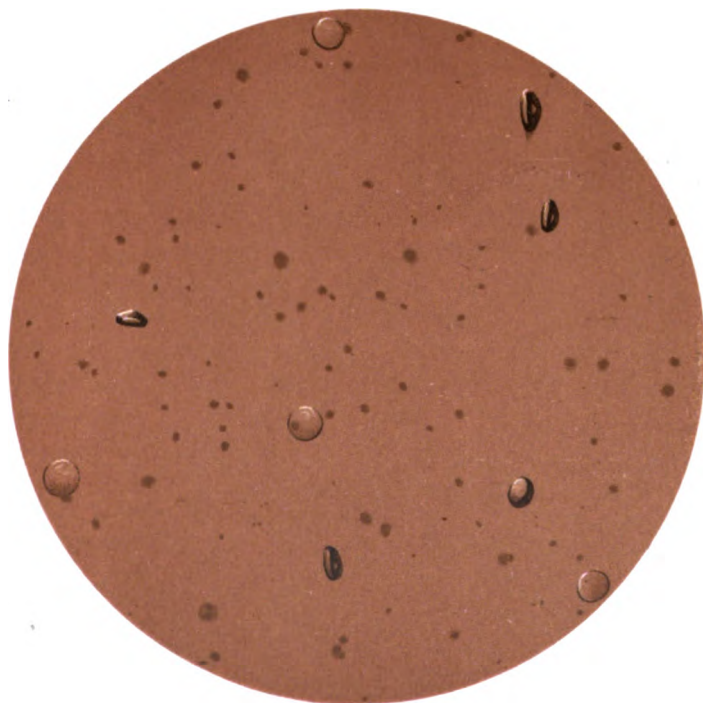


FIG. 2.—PETRI DISH CONTAINING CHARACTERISTIC COLONIES OF NECROSIS BACILLI. X 2.

one or two localized areas of coagulation necrosis. In another the caseous process had included the entire surface of both lungs, the pericardium, and the heart itself until all were superficially fused into one cheesy mass. The liver of one animal contained eight superficial areas of caseation varying in size from a pea to a hazelnut and was adherent to the diaphragm and abdominal muscles. All other organs were normal. No lesion was observed about the point of inoculation in three cases; the fourth showed a narrow strip of necrosis along the line of the vein for about half an inch. Cover-glass preparations made from the lesions contained numerous characteristic specimens of *Bacillus necrophorus*.^a

EXPERIMENTS ON MICE.

Subcutaneous inoculation.—The remarkable susceptibility of a white mouse to “necrophorus infection” makes this animal an excellent medium for the preservation of the virulence of that microorganism, as well as a means of obtaining it in pure culture. Unfortunately, this animal’s extreme susceptibility to many forms of the bacterial flora of the mouth disqualifies it for use in the early stages of an investigation. The inoculation experiments may be carried on by placing a small bit of necrosed tissue into a pocket in the skin of the back, or by injecting into the same region 0.1 c. c. of a fluid culture or emulsion containing the germ in a pure state. In two to four days the point of inoculation is covered with a rather thick, blackish, or dark-brown dry scab around which is a zone of redness. Beneath this scab proceeds a coagulation necrosis spreading through the subcutaneous tissues until the mouse is completely mummified, shriveled up, and covered with a dry parchment-like coating; or, penetrating into the body cavities in its course, successively caseates muscle, cartilage, bone, and viscera. In some of these cases so general becomes the caseous process that it is difficult to decide whether the viscera have suffered embolic necrosis or have become involved in the progressive caseation through extension by contiguity. In cases in which necrotic action was less widespread, small focal necroses containing the *Bacillus necrophorus* in pure culture were found in the lungs, liver, and spleen. In our experiments mice have died as early as five, and as late as twenty-one days.

^a While these pages were in press an interesting experiment in natural infection was completed. Rabbit 1262 died, presenting a complete picture of Schmorl’s disease. It had been associated with an inoculated rabbit affected with a “necrophorus” ulcer on the right ear, and was repeatedly noticed licking this sore spot. The necropsy revealed a necrotic stomatitis involving the gums, dental alveoli, body of the inferior maxillary, floor of the mouth, sublingual and submaxillary glands, and the tissues of the face and neck. There were no internal necroses. Cover-slip preparations and inoculations, both artificial and animal, demonstrated the presence of *Bacillus necrophorus*.

EXPERIMENTS ON GUINEA PIGS.

Guinea pigs were inoculated with pure cultures of necrosis bacilli by both the subcutaneous and intraabdominal methods, but these were followed by negative results. Nine animals were used in the experiments, and doses ranging from 0.25 to 1 c.c. of a forty-eight-hour bouillon culture were injected without producing any unfavorable effects. However, one positive result was obtained with guinea pig No. 3181, which was injected intraabdominally with 0.5 c.c. of an emulsion of the necrosed tissue taken from the mouth of calf No. 3. Death followed on the tenth day. On autopsy the carcass appeared emaciated. The point of inoculation in the prepubic region was surrounded by an abscess several millimeters in diameter containing a rich yellowish pus. In the linea alba several inches above this abscess was a metastatic nodule 1.5 cm. in diameter, involving the muscular tissue and the peritoneal lining. It contained the same character of pus. On the right side of the linea alba the peritoneum was adherent to the contiguous loop of the colon opposite the last rib. The right and left lobes of the liver were almost fused into one by abscess formation. The right lobe particularly was the seat of several abscesses 1½ cm. long by 1 cm. wide, with a line of demarcation plain and straight between the part absolutely necrosed and the invaded portion. The spleen appeared mottled and slightly enlarged, and the kidneys were deeply congested. The lungs were engorged on the right side and showed one or two foci of hepatization. The presence of *Bacillus necrophorus* in the liver abscesses was demonstrated by microscopic preparations and by animal inoculations.

EXPERIMENTS ON CHICKENS.

Four fowls were injected—two by intravenous and two by intramuscular inoculations—with 0.75 c.c. of a forty-eight-hour Martin's bouillon culture, but in no case was the result fatal. Nothing was observed that would indicate that the birds had been injected, and after a period of two months they were chloroformed. The postmortem examination revealed absolutely healthy birds.

EXPERIMENTS ON PIGEONS.

The inoculation of two pigeons indicated that the bacillus is not pathogenic for these birds. One pigeon was inoculated intravenously with 0.3 c.c. of a forty-eight-hour culture in Martin's bouillon, the other bird with 0.5 c.c. of a similar culture into the pectoral muscles. This experiment was concluded six weeks after its inauguration by chloroforming the pigeons, but in neither case was any abnormal condition apparent.

EXPERIMENTS ON CALVES.

Subcutaneous inoculations.—Heifer calf No. 351, 7 months old, was injected October 5, 1904, on the inside of the upper lip with 1 c.c.

of an emulsion prepared from the point of inoculation of rabbit No. 1215, which was the seventh in a series of animals inoculated with the material from a calf affected with necrotic stomatitis.

October 7.—There is a slight reddening about the site of injection, with a temperature of 102.6° F.

October 10.—The temperature has reached 103.2° F., and a large tumor with a soft center is observed at the point of inoculation. Pus can be seen oozing from the opening made by the needle in the lip.

October 11.—There is an enlargement about 1 by 2 by 1 inch in size at seat of injection, with an ulcerating surface surrounding the point of puncture.

October 12.—The caseous nodule is about the same size, and is still suppurating.

October 14.—The enlargement on lip does not appear to have increased any in size. An opening simulating a rodent ulcer about one-half inch in diameter has formed on the inner side of lip which leads to the pus cavity in the center of the necrotic area. Thick creamy yellow pus issues from it.

October 17.—The pus has been evacuated from the abscess in lip, and the lesion has begun to heal.

October 18.—The lesion in the mouth is healing rapidly, and the animal has been removed from the experiment.

On August 14, 1904, a fragment of necrosed tissue about one-half the size of a pea was inserted into a pocket made beneath the mucous membrane on the right side of upper lip of calf No. 318, 4 months old. The tissue was taken from the seat of injection of rabbit No. 822, the second in a series of rabbits inoculated with a pure culture of the *Bacillus necrophorus* obtained from the lip of a Berkshire shoat affected with necrotic stomatitis.

August 15.—Temperature of the calf is 103.2° F., and an inflammatory zone is noticed about the punctured mucous membrane.

August 17.—At the seat of inoculation there is a hard spheroidal enlargement about 1 inch in diameter.

August 18.—The abscess at point of inoculation has not increased any in size. A plug of pus and necrotic material of one-half cubic inch in volume has been extruded from the caseous nodule in the mucous membrane at the seat of injection.

August 19.—A small quantity of very thick pus is being secreted from the abscess. Temperature remains about the same as on previous days, 103° F.

August 22.—Only a small ulcer with a slight reddening at seat of inoculation remains. Temperature 104.8° F.

August 24.—Lesion is healing; appetite is good; temperature 104° F.

September 1.—The ulcer at seat of inoculation has about healed. Temperature 102.4° F.

September 12.—Animal removed from this experiment.

Roan calf No. 350, 2 months old, was inoculated May 24, 1904, on the lower portion of the left cheek with tissue taken from rabbit No. 1015, which was one of a series of rabbits injected with the necrosis bacillus obtained from a case of foot-rot in sheep.

May 26.—There is a reddening of the mucous membrane about the seat of injection.

May 27.—The animal appears dull and languid and eats sparingly. The mucous membrane is of a grayish color and presents an ulcer about 1½ inches in diameter.

• *May 28.*—A distinct and characteristic ulcer has formed, containing a caseous necrotic center surrounded by a zone of inflammation. From the caseous material scraped from the deeper portion of this ulcer rabbit No. 1117 was injected under the skin of the back. (This rabbit succumbed on the sixth day following, with characteristic lesions, from which the *Bacillus necrophorus* was obtained.)

May 31.—Point of inoculation in cheek of calf still shows ulceration, but swelling and inflammation are disappearing.

June 11.—Healing is about completed, there being only a small, depressed ulcer remaining.

Subcutaneous and intravenous inoculation.—On November 27, 1903, calf No. 337, 11 months old, was injected on the left side of tongue with 1 c.c. and inoculated in the right jugular vein with 5 c.c. of a culture of *Bacillus necrophorus* obtained from necrotic stomatitis of calves.

December 3.—The animal has remained perfectly well in every respect. No lesions.

December 16.—The calf to all appearances continues well.

December 26.—General condition remains good. Temperature has been normal throughout the experiment.

Owing to the negative result of this experiment it may be concluded that the animal in question was not susceptible to the injections, probably on account of its age.

Intravenous inoculations.—Gray calf, No. 359, was injected intravenously (right jugular vein) with 10 c. c. of a culture of the *Bacillus necrophorus* obtained from necrotic stomatitis of calves.

November 23.—The only reaction shown from the injection yesterday is the temperature of 103° F.

November 24.—The temperature reaches 106.8° F. The calf is now very sick, walks with a staggering gait, and hock joints are flexed much more than normal. It trembles, and eats scarcely anything.

November 25.—The animal shows about the same symptoms as yesterday, but more marked; pulse, 104.

November 26.—It is considerably weaker than on November 25, and has difficulty in getting on its feet. Temperature, 107° F.

November 28.—The condition is about the same; very weak, but can stand up; spiritless and refuses food.

November 29.—The calf seems somewhat weaker and walks with a staggering gait. Temperature, 104.6° F.

November 30.—It is still very weak and more stupid than yesterday; appetite is much improved. Temperature, 104° F.

December 1.—It shows no improvement in general appearance, but has a much better appetite.

December 2.—The condition is same as yesterday. Animal killed by bleeding.

The postmortem examination held shortly after death showed the carcass to be in a rather poor condition and the hair and skin dry and harsh. On opening the thoracic cavity the lungs were found to contain a number of encapsulated caseous nodules scattered quite regularly in the peripheral and superficial portions of the lobes. There were nine such areas in the right lung and seven in the left lung. Four of these nodules were surrounded by hemorrhagic zones, while

the remainder bore a striking resemblance to the early pulmonary lesions of caseous lymphadenitis of sheep, and were circumscribed by normal lung tissue. On sectioning they were seen to contain a yellowish white, thick, rather dry mass, from which the necrosis bacillus was obtained in purity. The liver showed three small superficial foci of necrosis the size of a grain of wheat, while the heart, spleen, and kidneys were apparently without lesions. No alteration of any kind was observed at the point where the intravenous injection was made. Culture media were inoculated with the caseous material from the necrotic areas in the lungs, and a rabbit was injected subcutaneously with similar material, with the result that characteristic development in the former case occurred within forty-eight hours, and in the latter case death of the rabbit followed on the eighth day with typical post-mortem lesions.

EXPERIMENTS ON SHEEP.

Subcutaneous inoculations.—On August 22, 1904, a small fragment of necrotic tissue, obtained from the same source as that used on calf No. 318, was introduced into a pocket made under the mucous membrane of the right cheek of sheep No. 23, about 1 year old.

August 24.—At the seat of inoculation in the mouth there is an inflammatory process which has caused a small patch of necrosis in the mucous membrane. Temperature 104° F.

August 26.—The ulcerous area in the mouth has reached one-half inch in diameter and is secreting pus. The inflammation and swelling are somewhat reduced. Temperature 103.6° F.

August 30.—The lesion at the point of injection is decreasing in size and the temperature of the animal is 102.4° F.

September 1.—The ulcer has nearly healed. Temperature 102° F.

September 9.—No lesion at seat of inoculation. Condition of animal is good.

Sheep No. 102, pure Merino, born in the fall of 1902, was inoculated May 9, 1903, on the lower lip with a culture of necrosis bacillus obtained from necrotic stomatitis of calves.

May 21.—No symptom of the disease has thus far appeared.

June 1.—No lesions are to be seen in the mouth, and the sheep seems to be well and gaining flesh.

June 5.—Animal is removed from experiment.

EXPERIMENTS ON PIGS.

Subcutaneous inoculation.—On October 5, 1904, pig No. 1448, weighing 50 pounds, was injected inside of upper lip on the right side with 1 c.c. of the emulsion obtained from the same source as that used on calf No. 351. Following the injection the pig continued in good condition, and no alterations were observed at point of inoculation until October 12, when a small inflamed swelling was detected, which showed a small necrotic center. By October 14 this enlargement had reached the size of a hazelnut, with a small ulcerative surface about 5 cm. in

diameter. The lesion remained stationary for several days, when healing started, and by November 2 the ulcer had almost disappeared. On November 12 the animal was in good condition, without any alteration at seat of injection.

PATHOLOGY.

The pathologic process which everywhere characterizes *Bacillus necrophorus* is a necrobiosis, involving coagulation necrosis with subsequent caseation, and marked by a progressive invasion of the surrounding (particularly the deeper) tissue and a remarkable tendency to metastasis. When this process is applied to a mucous membrane we have presented to us a diphtheric inflammation plus caseation.

A discussion of terms at this point is necessary for clearness of definition. The Greek *διφθερα*=diphthera, means membrane. According to usage in medical nomenclature "diphtheritis" should mean an inflammation of a membrane. It is unfortunate that this term, seldom used in English—more frequently used on the Continent—has been made synonymous with diphtheria. This latter term is used to-day to refer solely to that disease process evoked by the presence and activities in the tissues of the Klebs-Löffler bacillus. That process is characterized usually, if not quite always, by the production of a false membrane. At the time of the application of this term, and for years afterwards, it was supposed that etiologically, this process of inflammation characterized by membrane formation was always the same. Bacteriology has exploded this idea, and it is now known that this process can be provoked by numerous causes other than the Klebs-Löffler bacillus. We see no difficulty whatever in thus limiting the term diphtheria as above.

The adjective "diphtheritic" very naturally and properly associates itself with "diphtheritis." Hence, so long as diphtheritis and diphtheria are used synonymously so long will diphtheritic be associated with diphtheria as the qualifying adjective. So we find that among most writers a diphtheritic inflammation is an inflammation excited by the Klebs-Löffler organism.

A "diphtheric" inflammation, however, is an inflammation characterized by the formation of a *διφθερα*, or membrane. It is not synonymous with diphtheria, and may be induced by a variety of causes—mechanic, chemic, and microbic—other than Klebs-Löffler bacillus.

The name "calf diphtheria" is therefore incorrect when applied to necrotic stomatitis. The application of the adjective "diphtheric" is almost as misleading, since it stops short of a complete pathologic anatomy of the disease.

The principal lesions in necrotic stomatitis occur in the mucous membrane of the mouth and pharynx. The alterations may extend to the nasal cavities, larynx, trachea, sublingual lymph glands, lung, esophagus, intestines, and hoof. The oral surfaces affected are, in the order of frequency, tongue, cheeks, hard palate, gums, and lips. In the majority of cases the primary infection appears to take place in the tongue. The manner of infection in very young animals is connected, beyond all doubt, with the eruption of the first temporary teeth after birth or, in animals somewhat older, an inoculation which probably occurs most frequently by a sharp-pointed particle of food penetrating the mucous membrane. At the point of entrance the

system recognizes the presence and multiplication of the bacilli by a reaction marked by congestion and reddening, followed by an exudation rich in albuminoids or fibrin-forming substances, and a defensive immigration of leucocytes.

The metabolic products of the bacilli are exceedingly poisonous, killing everything with which they come in contact. Hence, the first effect of the organism is a necrosis, or death, of the superficial layer of epithelial cells and leucocytes at the seat of invasion. The cells either suffer fragmentation of their nuclei or become transformed into irregular flaky masses—the so-called hyaline masses. This constitutes superficial erosion of the mucous membrane. The process never stops here, though we may often recognize this stage in numerous recent foci of necrosis in a rapidly spreading form of the disease.

The second alteration is the production of false membrane by a combination of coincident changes. On the one hand, the necrosed epithelial cells and leucocytes, having lost their nuclei and finer structure, are deprived of their normal granulation and striation and take on a scaly appearance, being converted into hyaline substance; on the other hand, the albuminous exudate in which these dead cells are bathed precipitates fibrin or coagulates into fine threads. This is known as coagulation necrosis. The false membrane, then, is the result of coagulation necrosis of the inflammatory exudate and the entanglement in its meshes of the hyaline degenerated epithelial cells and leucocytes. This gives a grayish compact mass, more or less adherent to the underlying tissue which, by failure of the dead cells to be thrown off, may be built up an eighth of an inch or so.

The third alteration connected with this process is due to an invasion of the deeper tissues. The bacilli are always found on the border line between the living and dead tissue. Here, in great bundles of beaded filaments, they may be seen attacking the healthy tissue, which in turn has erected against the attack a wall of leucocytes, while masses of micrococci, tangles of streptococci, and clumps of bacteria are lodged in the superficial layers (pl. 2, fig. 1). Thus the process is carried down into the stroma or connective-tissue framework, and by the death of these deeper tissues are formed ulcers of varying depth. These may be sharply circumscribed, or at times diffuse, with thickened, slightly reddened borders surmounted by several layers of this necrosed tissue. The floor of the ulcer is formed by a grayish-yellow corroded surface, under which the tissue is transformed into a dry, friable or firm cheesy mass. In the tongue caseation may progress to two fingers' thickness into the muscular portion; in the cheek it may form an external opening permitting fluids to escape from the mouth; upon the palate it frequently reaches and includes the bone in its destructive course; upon the gums it has produced necrosis of the alveolar processes, causing loss of the teeth. By the coagulation necrosis occurring

in the region of the blood vessels, they become obstructed by pressure or sometimes by thrombosis, and thus the dead tissue becomes avascular, and the necrotic mass undergoes pulverization into finer and minuter particles until it is a dry, crumbly, yellowish mass of tissue detritus resembling cheese.

SYMPTOMS.

Necrotic stomatitis is both a local and a systemic affection. Primarily it is local. The local lesion is the caseonecrotic patch or ulcer, developed as a result of the multiplication of the bacilli at the point of inoculation. The general affection is an intoxication or poisoning of the whole system, produced by a soluble toxin elaborated by the bacilli.

The stage of incubation is from three to five days. Calves have shown signs of the disease when only three days old. During this stage the animal organism is passive and manifests no symptoms. The stage of invasion is twofold—local reaction against the invading organisms and constitutional manifestations of intoxication. The first symptoms noted are disinclination to take nourishment and some drooling from the mouth. An examination of the mouth at this time may show on the mucous membrane of the tongue, hard palate, cheeks, gums, lips, or fauces a circumscribed area of infiltration and redness, possibly an erosion. The latter gradually extends in size and depth, forming a sharply circumscribed or at times a diffuse area of ulceration (pl. 1). It may measure anywhere from the size of a 5-cent nickel piece to that of a silver dollar or even larger. It has the appearance of a corroded surface, under which the mucous membrane or lingual tissue seems transformed into a dry, finely granular, or firm cloddy mass. It is grayish yellow in color, and is bordered by a zone of thickened tissue, slightly reddened and somewhat granulated. The necrotic tissue is very adherent and can be only partially peeled off. It is homogeneous, cheesy, and may extend to the depth of one inch into the underlying tissue, involving the muscular tissue or even the bones. The general symptoms are languor, weakness, and slight fever. In spite of plenty of good food, the calf is seen to be failing. It stops sucking, or, if older than a suckling, altogether refuses to eat. The temperature at this time may be from 104° to 107° F. The slobber becomes profuse, swallowing very difficult, opening of the mouth quite painful, and a most offensive odor is exhaled. The tongue is swollen and its motion greatly impaired. Sometimes the mouth is kept open, permitting the tumefied tongue to protrude. One or more of the above symptoms direct the attention to the mouth as the seat of disease; or, having noticed the debility and disinclination to eat, an examination of the animal may show a lump under the neck or swelling of the

throat or face as a result of the large partially chewed boluses of food that have collected there.

The following extract from a letter is characteristic:

I noticed my calves beginning to fail about the first week in December, but could not account for it, as they were getting plenty of grain and hay. My attention was first attracted by a swelling under the neck of one of the calves. I cast the animal and found it was food that had collected and the animal couldn't swallow it. I removed the food, and in so doing noticed a large ulcer on the tongue and a very offensive odor. This was the first knowledge I had of anything being wrong with the calves' mouths. They may have been sick for sometime before this.

Out of a herd of 100 belonging to this man, 70 were affected, and the letter emphasizes the insidious character of the onset.

The general affection at this time manifests itself by dejectedness, extreme weakness and emaciation, constant lying down, with stiffness and marked difficulty in standing.

The disease frequently extends to the nasal cavities, producing a thin yellowish or greenish yellow sticky discharge which adheres closely to the borders of the nostrils. Their edges also show caseous patches similar to those in the mouth. Sometimes the nasal passage is obstructed by great masses of the necrosed exudate, thus causing extreme difficulty in breathing. When the caseous process involves the larynx and trachea, there result cough, wheezing, and dyspnea, together with a yellowish mucopurulent saliva. When life is prolonged three or four weeks, caseous foci may be established in the lung, giving rise to all the signs of a broncho-pneumonia. Many of these cases are associated with a fibrinous pleurisy. The invasion of the gastrointestinal tract is announced by diarrhetic symptoms.

In pigs the symptoms are practically the same as have been described for calves, although the tongue is not so likely to be involved. The mouth becomes necrosed in patches, especially in the region of the front teeth and tusks. Suppuration and destruction of tissue around the teeth may be so great that they finally become loosened and fall out. The jaws are swollen and the lips show cracks and scabs. The snout is frequently involved, resulting in some cases in necrosis of the end of the nose. The disagreeable odor exhaled from the mouth and the tendency of the affection to spread to the larynx, pharynx, and tonsils, and the mucous membrane of the stomach and intestines are greater with pigs than with calves. When the intestines become involved, a black offensive diarrhea is manifested, the pigs are dull, refuse to suckle, and are inclined to remain recumbent. Prostration and emaciation are especially marked when the digestive and respiratory organs are involved.

COURSE AND TERMINATION.

In the very acute form of the disease many of the cases run their course in five to eight days. In these the local lesions are not strongly marked, and death seems due to an acute intoxication. In other enzootics the majority of the affected animals live from three to five weeks. These are the cases that usually present the pulmonary and intestinal symptoms, and sometimes develop, in the case of bovines, caseonecrotic lesions of the liver.

INFECTIVE CHARACTER.

The consideration of this aspect of the disease involves a study of its infectiveness for animals and also the question of its transmissibility to man. Under the former must be considered the infection of an isolated case or the initial infection of a group of cases, the transmission of the disease from animal to animal of the same variety or species, and its transmission from animals of one species to those of another.

Necrotic stomatitis is enzootic—never epizootic; that is to say, instead of covering a wide area, like foot-and-mouth disease or pleuropneumonia in their march of devastation, it involves in its infection only the members of a few herds or the animals on a single farm. This is due largely to the nature of the infective agent. Being a strict anaerobe and not very resistant to germicidal influences, such as light, there is, under what are termed natural conditions, little possibility of the conveyance of the microbe from place to place. Another characteristic of the *Bacillus necrophorus* is that it is, strictly speaking, a secondary invader. This requires special conditions of receptivity on the part of the animal infected. For example, there must be a break in the continuity of the tissue to which the necrosis bacillus is applied.

It should be stated here that the *Bacillus necrophorus* is not to be regarded as a saprophytic guest of the intestines of hogs and herbivora which, under certain conditions, develops pathogenic properties. It is always and everywhere the producer of a progressive tissue necrosis characterized by caseous degeneration. Whether in or out of the intestine, whether in manure on the stable floor, or buried deep in the tissues of a susceptible animal, it always possesses this pathogenic property. But in the lumen of the intestine, possessing an intact epithelial lining, the necrosis bacillus is, for the time being, without effect. However, let this epithelium be injured by a foreign body, by corrosive fluids, by the action, for instance, of the hog cholera bacillus, and at once an entrance into the intestinal wall is afforded the necrosis bacillus, with the result that there develop diarrhea and caseonecrotic patches in the intestines. This relationship of the intact epithelial covering to bacteria normally present in the intestine was well

brought out in Jensen's experiments on calves with reference to white scours.

As to the infection of a single calf or pig or the initial infection of a herd, it is evident that, inasmuch as the *Bacillus necrophorus* is a normal inhabitant of the intestine of healthy hogs and presumably of cattle, the manure may be looked upon as the chief agent in transmission. Hence a most common method of infection in the calf or pig, when the gums are abraded or torn in connection with the eruption of the teeth, is suckling the cow or sow when the teats are filthy with manure. Again, the animal munching a little hay or straw which has been contaminated with manure may receive a stab at some point of the mucous membrane of the mouth by which the necrosis bacillus is introduced into the tissues.

The transfer of the disease from one animal to another occurs time after time when newly born animals are placed successively in a pen previously occupied by an animal that had contracted the disease. In this connection it must be remarked that the question is not alone that of the transmission of the disease of necrotic stomatitis, but of the transfer from one animal to another of the infective agent. In whatever part of the animal body the *Bacillus necrophorus* may have instituted the caseonecrotic inflammation which characterizes its pathogenic rôle, by whatever name the disease process may be called, be it foot-rot, necrotic quittor, necrotic scratches, necrotic vaginitis, or metritis or necrotic stomatitis, there we find a hotbed of infection and the certain groundwork of an enzootic. Hence the occupancy of the calving stall by a cow affected with panaritium or by a cow suffering with a vaginitis dependent upon this bacillus is sufficient to insure the development of a series of cases of necrotic stomatitis. The same principle is involved in the dissemination of the disease through one or more litters of pigs. The very first investigator in this line made the experiment of placing a healthy calf in a stall with two calves affected with the disease. The third calf came down in five days with the same malady. The author considered the calves' habit of licking one another as being chargeable with the transmission of the disease. Blažeković⁵ also reports an unintentional experiment of the same sort. The exposed calf began to cough in three or four days, after which the necrotic patches were visible in its mouth. It is also recognized that the practice of feeding calves from the same vessel or bucket and pigs from the same trough may be responsible for the transmission of the affection.

The proof of the transmissibility of the disease from one species to another was secured by Dainmann,⁹ who inoculated a bit of necrotic material from the mouth of a calf, dead with the disease, into the mouth of a four-days-old lamb. In four days the lamb died, with postmortem findings which established the success of the experiment.

It may safely be assumed that any species which has shown a susceptibility to the bacillus in any portion of the body may be attacked with necrotic stomatitis, the conditions for the inoculation of the germ being present.

The study of the transmissibility to man of necrotic stomatitis of animals involves not only the question of the pathogenicity for man of the infective agent of necrotic stomatitis, but also that other interesting and important question of the relation of animal diphtherias to man. This latter question will be treated separately. The former question is not really involved in the latter because, as we have shown, necrotic stomatitis is not a diphtheria. Still, of interest are the questions, Can man contract disease from cases of necrotic stomatitis in animals? Is *Bacillus necrophorus* pathogenic for man? An affirmative answer to the second makes probable an affirmative answer to the first.

No help in answering the questions can be gathered from Dammann's experiences, since in his cases it was also the question of a virulent micrococcus infection, and the sore throats in men referred to by him were no doubt infections of this sort. However, Schmorl records the case of himself and servant in the laboratory, both of whom developed small digital abscesses, in the contents of which were demonstrated both micrococci and undoubted forms of *Bacillus necrophorus*. When it is remembered that guinea pigs, ordinarily immune, may be successfully infected with *Bacillus necrophorus* when the tissues have been previously invaded by a micrococcus, it is readily seen that, under like circumstances in man, the necrosis bacillus might play the rôle of a secondary invader. Right here it must be remembered that, as already referred to, Löffler had met with *Bacillus necrophorus*, not only in his caldiphtheria investigation, but also in some experiments looking toward the transmission to rabbits of syphilitic products. Out of four rabbits inoculated in the anterior chamber of the eye with bits of a condyloma latum, two died with local and metastatic necrosis, exhibiting the characteristic bacteriological pictures of *Bacillus necrophorus*. Löffler also makes the statement that he had several times seen, in addition to others, similar bacteria in the surface exudate of ulcerating condylomata lata, and that such bacteria were also present in the exudate of the inoculated condyloma. Jensen makes the suggestion that the deeply penetrating necroses, for example, of the intestine after typhoid and scarlet fevers, of the throat in scarlet fever, of the cheeks (noma) after scarlet fever, measles, etc., of the fingers in panaris, offer interesting fields of investigation with reference to the presence of *Bacillus necrophorus* in man.

SUSCEPTIBILITY.

Necrotic stomatitis attacks principally sucklings not over six weeks of age, but calves and pigs eight to ten months old are frequently

affected, and several cases of adult cattle showing the disease have been reported in the works of Bang,¹ Jensen,³⁰ Berg,³ and others; also in two-years-old hogs in our correspondence from pig raisers. Moreover, Dammann,¹⁰ Löffler,⁴² and Diem¹² have noticed the natural occurrence of this affection in lambs. The presence of the disease in various other species has already been referred to in a previous chapter. Sex and breed play no rôle in reference to this malady, as it is not confined to either male or female nor to any particular breed or breeds.

ECONOMIC IMPORTANCE.

Although occasional reports of a rapidly fatal disease affecting the mouths and throats of calves have been forwarded to this office from various sections of the West during several years past, no fresh material for an investigation into the nature and cause of the affection could be procured until 1902 and 1903, when a number of rather severe outbreaks occurred in Colorado, western South Dakota, and eastern Wyoming. From the history, symptoms, and lesions of the affected animals described in these letters, it seemed probable that the disease was the so-called calf diphtheria of Europe, but this suspicion could not be verified until specimens of the diseased heads of calves were received through Dr. A. B. McCapes, at that time State veterinarian of Colorado, to whom we extend our thanks. Very little is positively known of its prevalence in this country, owing to the lack of familiarity of stock owners and veterinarians with the disease, but it is doubtful if its appearance here is of recent origin. The very fact that the causative agent (*Bacillus necrophorus*) of this disease has also been isolated in this laboratory from abscesses in the livers of cattle slaughtered at Kansas City and Chicago, from the liver of a deer from the National Zoological Park, and from sheep affected with foot-rot, would indicate that the organism is widespread in this country, only awaiting an opportunity for entering the tissues of a susceptible animal.

In reviewing the economic importance of this disease, consideration must be given to the other infections produced by *Bacillus necrophorus*, some of which are even more grave than necrotic stomatitis. The presence of the latter disease on a farm would indicate the possibility of the causative germ affecting other susceptible animals in tissues already referred to in the chapter on pathogenesis. Thus the importance of this organism is far beyond even its relation to necrotic stomatitis of calves and pigs since foot-rot of cattle and sheep, necrotic inflammation of the uterus and vagina of cows, a similar inflammation of the large intestine, and necrotic scratches of horses, gangrenous processes of the lips and nose, and necrotic stomatitis in sheep, may all follow on premises contaminated with the infectious principle of this disease. Among the letters that have been received

requesting information relative to this malady, the following will convey a general idea of its nature and importance:

Within the last two weeks several complaints from different parts of the State, mostly from the mountain regions, have come into this office regarding a disease in calves that were dying from sore mouth. I have just returned from Gunnison, where I examined several calves that died of this disease. I found that at the base of the tongue and in the larynx there were large sores, some of them as large as a silver dollar. They presented a thickened croupous matter usually white in color. After this matter was scraped off with a knife, a red granulated membrane was left. The owner told me that in some cases these sores appeared on the anterior part of the tongue, but in the cases I saw they were at the base of this organ. The trouble occurs in sucking calves of one to three months old. The first symptoms noticed are that they can not swallow, and soon cease to nurse. In calves that are old enough to eat hay or other forage, large boluses of food are found between the lips and teeth, giving the appearance of a large swelling on the side of the face. Practically speaking, 90 per cent of the affected calves have died. One party lost 21, another 10, with no cases recovering on their farms.

Another correspondent from Salida, Colo., writes:

We have lost 33 calves with throat and mouth disease and will lose more.

A stock owner, writing from Lithia, S. Dak., states:

There is a disease attacking my calves and which is new to the cattlemen of this vicinity. The calves stop eating; about three days after they begin to foam at the mouth, but continue to move their mouths. The throat swells very hard and the jaws are set tight, so that they can not open. A foamy pus discharges from the nose two days before they die, and they seem to strangle to death from accumulation of this pus in the nose and throat. They have high temperature and stand up and lie down alternately during the last two days. The bowels move freely and there is a tendency to urinate frequently. Death occurs in four or five days. Upon cutting into the throat or larynx and nasal cavities, they were found completely filled with thick pus. The muscles around the larynx and throat and back and under the tongue seemed to resemble the contents of an abscess. The heart and lungs seemed to be in their natural condition. I now have 7 head that have this disease.

From Aladdin, Wyo., the following was received:

A disease has broken out among my calves. I have 117 head and I believe half of them have sore or ulcerated tongues. I can not see that they are affected otherwise. The sore is generally located on the top of the tongue about the center and in some cases has eaten the tongue nearly in two. Two head have died, and in one of them nearly the entire surface of the back half of the tongue had rotted away and contained numbers of cavities filled with pus, but I could not find any foreign substance in them.

A letter from Belle Fourche, S. Dak., indicates that the disease is amenable to treatment.

There are a number of herds (calves) affected in this country, and I know of 1 cow. I have been using boracic-acid wash for mine, and they seem to be improving.

A ranchman sends the following record of his observations from Bixby, S. Dak.:

All of my calves and some of my yearlings have some kind of a disease. Their jaws swell and sometimes their throats, and when I come to examine them I find

that their jaws are sore on the outside of the grinders and inside the cheek. In some it rots holes in their tongues, mostly at the back part. The breath smells terribly and the calves get dumpy and poor.

A letter from Masonville, Colo., suggests the possibility of the disease originating from foot-rot in cattle.

I should like your opinion of what might be called an epidemic among my calves. Three of them have been attacked with swellings in the lower jaw on both sides. Yesterday one of the calves died, and on examining the jaw I found it apparently rotten on the inside from the grinders down. There was no pus. Last summer I noticed a calf of this same herd similarly afflicted, but it came out all right. Last summer about 10 per cent of my cattle were troubled with their feet cracking between the hoofs. They became very lame.

Mr. G., of Wheatland, Wyo., requested—

information regarding some young calves I have. There are 2 calves less than a month old running with their mothers. One of them has his jaw swollen up on one side. The other calf has both sides of the jaw and under the jaw swollen. I examined their mouths and found "canker" alongside and behind their teeth, and it was awfully offensive. A few weeks ago I lost one six-months-old calf with a similar disease.

Many cases of sore mouth in pigs are reported from various sections of this country, and, assuming that these cases were similar to those investigated by us, it would seem that this disease causes the death of many young animals and also stunts the growth of many that survive. Almost every pig in the litter suffers, and litter after litter becomes affected. The same lack of recognition of the disease as in calves prevents any accurate description of the importance of the affection in pigs, but in a few outbreaks observed it was noted that from 60 to 90 per cent of the animals in the herd died if left untreated. The disease in pigs, while usually affecting the young, has been reported at all ages, from sucking pigs one week old to hogs two years of age. One writer reports a loss of 33 out of 50, another 33 out of 37, while a third states that of 12 four-months-old shoats 11 succumbed to the disease.

DIFFERENTIAL DIAGNOSIS.

Necrotic stomatitis may be differentiated from foot-and-mouth disease by the fact that in the latter malady there is a rapid infection of the entire herd, as well as of any hogs or sheep that may be on the premises; it is also highly infectious, spreading rapidly to neighboring herds and to cattle of the same herd. The characteristic lesion of foot-and-mouth disease is the appearance of vesicles containing serous fluid in the mouth, upon the udder, teats, heels, and coronary bands of the affected animals. Drooling is profuse, and there is a peculiar smacking sound made by sucking the affected lips. In hogs the mouth is not so likely to be affected as are the feet. Foot-and-mouth

disease has appeared in this country on four occasions only, always near a seaport, and does not exist in the United States at the present time. In necrotic stomatitis vesicles are never formed, necrosis occurring from the beginning and followed by the formation of yellowish patches, principally in the mouth.

Mycotic stomatitis is a sporadic disease which affects cattle of all ages that are on pasture, but more especially adult animals. It is characterized by inflammation and ulceration of the mucous membranes of the mouth, producing salivation and inappetence, and, secondarily, affecting the feet, which become sore and swollen. Superficial erosions of the skin, particularly of the muzzle, and of the teats and udder of cows may also be present. It occurs only in a few animals of the herd, usually in the early fall after a dry summer; it does not run a regular course and can not be inoculated.

Actinomycosis of the tongue may occur as superficial erosions but is usually deep-seated, where, instead of producing ulceration and destruction of the mucous membrane, it causes a diffused induration of the muscular tissue of the tongue, resulting in an enlargement of that organ. Hence the term "wooden tongue" has been applied to this condition. The course of the disease is chronic and the tongue is extensively affected before attracting the attention of the owner. The indurated tissue when incised is found to be hard and gritty and contains bright yellow sulphur-like granules of actinomyces, which are the causative agents of the disease.

PROGNOSIS.

Ordinarily animals affected with necrotic stomatitis show no tendency to spontaneous cure. Left to themselves, they either die or become permanently stunted in growth. On the contrary, if taken in hand early, the disease is readily amenable to treatment. In the latter event the prospects of recovery are excellent, and under favorable conditions it takes place as a rule in twelve to fifteen days.

TREATMENT.

PROPHYLAXIS.

Prophylaxis should be carried out along three lines: (1) Separation of the sick from the healthy animals; (2) close scrutiny and thorough disinfection once daily for five days of the mouths and nasal passages of those animals that have been exposed by the eruption of the first teeth, by the shedding of the milk teeth, or through association with affected animals; (3) complete disinfection of all stalls, sheds, and

farrowing pens with a 5 per cent solution of carbolic acid to which has been added sufficient lime to make the disinfected area conspicuous.

The disease appears to break out in winter and holds over to spring. It is conceivable that exposure to cold might so disturb the normal circulation of the oral tissues as to make the mucous membrane an excellent location for the development of the causative factor of the disease. There is another possibility, however, which bears on the third line of prophylaxis. The diphtheric inflammation of the vagina and uterus in cows is caused by the same organism that induces necrotic stomatitis. Ellinger¹³ has recently pointed out the almost constant relation of such attacks to previous occurrences of foul-foot or foot-rot in the same or other cattle on the place. In all likelihood, the stalls and sheds are the harborers, in such cases, of this germ. Why may it not be that many of these outbreaks of necrotic stomatitis in calves have some relation to preceding cases of the above-mentioned diseases and the greater use in winter of stalls and sheds harboring the *Bacillus necrophorus*; and in pigs to the fact of their following cattle affected with one of the above diseases?

THERAPEUTICS.

The treatment consists almost solely in careful and extensive cleansing and disinfection of the mouth and other affected surfaces. The mucous membrane of the mouth should be copiously irrigated with a 2 per cent creolin solution in warm water. This should be performed at least twice daily, but care should be used with this as with all other antiseptics, to prevent swallowing of any considerable quantity of the solution. Since exposure to oxygen kills the bacilli one need have no fear about disturbing or tearing off the caseous patches or necrotic tissue during irrigation. The irrigation of the sores should be followed by the application with a brush or rag on a stick of a paste made with salicylic acid 1 part and glycerin 10 parts; or the affected spots may be painted with Lugol's solution of iodine (iodine 1, potassium iodide 5, water 200). Frequent injections into the mouth of a 1 per cent carbolic-acid solution make an excellent treatment. In calves the internal administration of 2 grams of salicylic acid and 3 grams of chlorate of potash three times a day has also proved very beneficial.

A very simple and efficacious method of treating pigs is to catch them and hold their heads for a few moments in a solution containing in each gallon of water 2 ounces of potassium permanganate, or in a solution of creolin of like strength. This treatment may be repeated twice daily for six days.

If the predisposed animals are sucking, it would also be advisable to bathe the udder and teats of the cows or sows with a 5 per cent solu-

tion of carbolic acid in order to prevent infection from the probably contaminated manure on these parts. In animals that have been weaned it will be necessary to feed soft, nutritious food, such as whole milk, bran mash, ground feed, and gruels, and to keep clean, cool water constantly within reach.

RELATION OF ANIMAL DIPHTHERIAS TO MAN.

We have already shown that the cause of necrotic stomatitis and the cause of human diphtheria are entirely distinct microorganisms. We have also shown that the disease process in necrotic stomatitis of animals is markedly different from that in human diphtheria. A superficial resemblance in the local manifestations of the two diseases and a total misconception of the cause of each gave rise to an identity of terms which is confusing. As we have elsewhere stated, calf diphtheria is a misnomer, false in its characterization of the disease, and misleading in its effect upon the mind of the public. The same statement holds with reference to so-called chicken diphtheria, or roup, and similar affections in avian species. Many different species of the mammals have revealed disease processes in mouth and throat that superficially resemble the diphtheritic process in man, but the weight of evidence at the present time goes to show that the pathological alteration in many of these cases is not identical with that in human diphtheria. However, satisfactory proof has been offered of the recovery of the bacillus of diphtheria from a few isolated cases, especially in the cat, horse, and dog. At this point we would remind the reader that in the human family diseases of the mouth, throat, and upper air passages frequently arise which closely simulate diphtheria, giving rise to almost identical clinical manifestations, but which upon bacteriological examination fail to yield the Klebs-Löffler bacillus, thus proving them to be distinct from diphtheria. In view of the apparent resemblance between the true and false diphtherias of man and animals, and because the former disease appears to be intercommunicable between man and animals, we urge upon the reader the isolation of all animals, particularly pets, affected with mouth and throat diseases, and the most punctilious observance of all details of sanitary precautions.

DISPOSITION OF MEAT OF AFFECTED CARCASSES.

If necrotic stomatitis were transmissible to man, the germicidal action of cooking might be counted on to obviate such danger. Proof that necrotic stomatitis is not transmissible to man does not demonstrate that the meat of animals so affected is fit for food. Other factors enter into this question of the edibility of such meat. The disease

may be regarded as at the first a local affection. Now it is manifest that those portions of the animal body affected with caseonecrotic patches should be condemned for food. The remaining portions of the carcass, however, if in a good state of nutrition, might be placed on the market.

On the other hand, should the disease have progressed beyond the condition of localization to a condition of toxinemia, which would be evidenced by emaciation, enlargement and discoloration of the lymph nodes, and cloudy swelling of the liver, the carcass should be rejected as both innutritious and noxious.

CONCLUSION.

We may note that in necrotic stomatitis of animals we have to do with an acute, infectious inflammation of the mouth and upper air passages, of widespread occurrence both geographically and zoologically, caused by the invasion locally of a thread bacterium, the *Bacillus necrophorus*, a nonmotile, polymorphic anaerobe, inhabiting normally the intestinal tract of hogs and, in all probability, of herbivora, and found also in manure.

The disease is observed most frequently in calves and pigs, and usually in connection with the eruption of the first teeth, although other injuries of the mucous membranes may be the starting point. The disease process is a clearly defined cheesy degeneration of a progressive coagulation necrosis characterized by the formation of ulcers and caseonecrotic patches, and manifesting itself clinically by salivation, refusal to suck, difficult breathing, and rapid emaciation. The duration of the disease is from five days to five weeks, these animals, if untreated, dying early with a toxinemia. Necrotic stomatitis is not difficult of diagnosis and may quite easily be differentiated from other inflammations of the mouth, is most amenable to treatment, and hence offers a highly favorable prognosis. The exquisitely infectious nature of the cause rendering most easy the rapid development of an enzootic, and favoring the spread of other forms of bacillary necrosis, some of them even more grave than necrotic stomatitis, lifts the disease to a high place in agricultural economics. Evidence is not at hand for pronouncing it transmissible to man, and it is absolutely distinct from human diphtheria.

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INFORMATION

— CONCERNING —

THE MILCH GOATS.

BY

GEORGE FAYETTE THOMPSON, M. S.,
Editor of Bureau of Animal Industry.



WASHINGTON:
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1905.

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U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF ANIMAL INDUSTRY—BULLETIN NO. 68.

D. E. SALMON, D. V. M., Chief of Bureau.

INFORMATION

CONCERNING

THE MILCH GOATS.

BY

GEORGE FAYETTE THOMPSON, M. S.,
Editor of Bureau of Animal Industry.



WASHINGTON:
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1905.

LETTER OF TRANSMITTAL.

UNITED STATES DEPARTMENT OF AGRICULTURE,
BUREAU OF ANIMAL INDUSTRY,
Washington, D. C., January 4, 1905.

SIR: I have the honor to transmit herewith a manuscript entitled "Information concerning the milch goats," by George Fayette Thompson, M. S., editor of this Bureau. Since the publication by this Department of bulletins on the subject of Angora goats, there has developed an interest in milch goats which has increased to almost a public demand for a publication on that subject; and the manuscript transmitted herewith is designed to answer the questions that have been received by this Bureau touching the various phases of a milch goat industry. The author makes no pretense of embodying personal experiences in this paper, but has given the facts and opinions as they have been gleaned from European writers on the subject; but he believes that the statements contained in this paper are the more valuable because of having been measured by the general rules that govern the raising of Angora goats and sheep.

Acknowledgments are cheerfully made of the assistance received from owners of milch goats who have furnished information and photographs.

I recommend that this manuscript be published as Bulletin No. 68 of the Bureau of Animal Industry series.

Respectfully,

D. E. SALMON,
Chief of Bureau.

Hon. JAMES WILSON,
Secretary of Agriculture.

CONTENTS.

	Page.
Some preliminary remarks.....	9
Present situation	11
Economy of goat keeping	12
Climate and soil.....	13
A consideration of the milk	14
Characteristics of goat's milk.....	17
Yield of milk	17
Composition of the milk	19
Flavor and odor of the milk.....	20
Period of lactation.....	21
The operation of milking.....	22
Transportability of the goat giving milk.....	23
Goat dairies.....	24
Goat's cheese	25
Goat's butter.....	26
Goat's whey	26
Immunity from tuberculosis.....	27
Management of the goats	29
The goat barn and yard.....	30
Bedding in the goat barn	32
Fences	33
Salting the goats	33
Watering the goats	34
Care of the hoofs.....	34
Feed for milch goats.....	34
Concerning diseases of goats.....	37
The matter of breeding	37
The breeding age.....	39
The time to breed.....	39
Number of kids at one birth	39
Raising the kids.....	40
In-and-in breeding	41
Hardiness of goats.....	41
Points to be observed in purchasing goats	42
Prices of milch goats.....	43
Where to purchase goats.....	43
Length of a goat's life	44
How to determine the age	44
Goat's flesh as food.....	45
The skins	45
Milch goats as brushwood destroyers	46

	Page.
The matter of fertilizer	47
Horns or no horns	47
Wattles on the neck	47
Worrying by dogs	48
Importations and importing	48
Registration	49
Breeds of milch goats	50
The milch goats of Switzerland	73
Goats in Norway and Sweden	78
Literature consulted	81

ILLUSTRATIONS.

PLATES.

	Page.
1. American milch goats	48
2. Queensland milch goats	48
3. American milch goats and Australian common goats	48
4. Figs. 1 and 2, Poona (India) goats; fig. 3, Spanish-Maltese goat.....	52
5. Maltese milch goats.....	52
6. Maltese milch goats.....	52
7. Figs. 1, 2, and 4, imported Toggenburg goats; fig. 3, Schwarzwald goat....	56
8. Toggenburg goats in Switzerland.....	56
9. Imported Toggenburg goats	56
10. Saanen goats in Switzerland	56
11. Langensalzaer goats.....	64
12. Fig. 1, Hinterwälder doe; fig. 2, Schwarzenburg-Guggisberger doe	64
13. Spanish milch goats.....	64
14. Figs. 1 and 2, common goats of Egypt; fig. 3, Zairibi goat.....	72
15. Fig. 1, Syrian goats at Nazareth; figs. 2 and 3, goats in Athens.....	72
16. Figs. 1 and 2, goats near Hammerfest, Norway; fig. 3, goats in southern Norway.....	80

FIGURES.

1. Plan of goat house	30
2. Suitable goat stalls	31
3. How teeth show the age of goats.....	45
4. Schwarzwald goat.....	58
5. German farm (or house) goat.....	61
6. Nubian goat	67
7. African Dwarf goat	70

INFORMATION CONCERNING THE MILCH GOATS.

By GEORGE FAYETTE THOMPSON, M. S.,
Editor of the Bureau of Animal Industry.

SOME PRELIMINARY REMARKS.

In these days the American people are not only willing but anxious apparently to take up the work of any line of inquiry or experimentation that will add in any particular to the wealth or happiness of mankind. Mere sentiment exerts but little influence in such matters. "Will it pay?" is the chief question concerning any new proposition, whether it be the establishment of an animal industry, a factory, or a college, and the permanency of the thing proposed depends upon an affirmative answer to this question. So it is that such specialties as the raising of chickens, ducks, geese, ostriches, frogs, etc., on a large scale have been established.

Notwithstanding the above facts, all special industries like those named are beset with ridicule to some extent and are thus oftentimes unmistakably hindered in their progress. Those who have become interested in goats have expected more of such ridicule than they have actually received, and it can now be said that everybody is the friend of the Angora. Probably the highest compliment that was paid to the author's bulletin on the Angora goat was by one of the celebrated papers devoted to humor, in these words: "The only funny thing about the book is that the author treats the subject seriously." The author could wish for no higher compliment for this work on milch goats. The goat has been the friend of man from the beginning and it can not be spared now without creating a deficiency in the sum of human comfort and happiness.

Since it has become evident that the Angora goat industry is quite securely established throughout the country generally, many people have very naturally begun to consider the possibilities of another industry, which in some respects is closely allied to it, namely, the milch goat industry; and the Bureau of Animal Industry has found it necessary to gather a large amount of data in order to answer the numerous questions that it has received concerning every phase of milch goat management. These requests have come mainly from two

classes of our citizens—those who were reared in foreign countries where goat's milk was very largely or solely used and those who have read of the economy of goat keeping and the reported value of the milk for children and sick people. The second class includes many physicians who, believing in the hygienic virtues of goat's milk, would like to see goat dairies established in the neighborhood of all large cities, so that a constant supply of the milk might be available at all times.

Milch goats are a prominent feature of the live stock industry of Europe, especially in Switzerland, Italy, Germany, Austria, France, Norway, and Spain. They are peculiarly adapted to the needs of the poorer classes of those countries, and, to a large extent, it is this adaptability that recommends them for many localities in the United States. This is so because milk, which is food and drink to all mankind, is furnished by the goat in cheap form, because for most purposes its quality is superior to cow's milk, and also because the yield of milk, when size of animal and amount of feed are concerned, is much greater than that of a cow.

The number of goats in the world could be only roughly estimated, and to say how many milch goats there are among them would be but a guess. German writers on milch goats have estimated that there were about 3,000,000 goats in the German Empire in 1892. As there was an increase shown for every decade from 1873, it is probable that the number is considerably augmented at the present time.

Dettweiler (1892) gives some statistics regarding the milch goat industry of Germany which are interesting. His estimate of the annual value of the goat business is as follows:

Goats and goat products in Germany, 1892.

Value of goats.....	50,000,000 marks (\$11,900,000)
Value of milk produced.....	150,000,000 marks (35,700,000)
Value of kids slaughtered.....	7,500,000 marks (1,785,000)
Value of goats slaughtered.....	6,500,000 marks (1,547,000)
Total.....	214,000,000 marks (50,932,000)

It therefore appears that the milch goat industry of Germany is worth annually about \$39,000,000, after the value of foundation flocks is deducted. It is indeed a business of no small importance, and for the whole of Europe the total value must certainly reach enormous proportions.

It is officially stated that the production of goat's milk in Switzerland in 1901 was 19,875,000 gallons. At an estimated value of 10 cents per quart, this equals nearly \$8,000,000. The number of goats there of both sexes and of all ages for that year was 354,534, which was 135,000 more than the number of sheep. Although Switzerland

is peculiarly adapted to goat raising, we should remember in making comparisons and estimates that her total area is about 16,000 square miles only, and that much of it is in mountain tops entirely unavailable for any use. Indiana is more than twice as large as Switzerland, and Texas has an area more than sixteen times as great. All this shows that the goat business of that little Republic is of considerable importance, yet most cyclopedias and gazetteers mention it in a word only or not at all.

PRESENT SITUATION.

The present situation regarding a milch goat industry in the United States is confined largely to an awakening interest, although there are now some communities of foreigners where a considerable number of goats are kept for milk, the kids being fitted for slaughter. This is specially true of Italian colonies. Besides, correspondence of this Bureau has brought to light the fact that occasionally in isolated places the common American goat has for some time been kept in very small numbers for milk production. The matter has been given no publicity, yet the goats have apparently fulfilled all expectations. For instance, A. M. Evans, Lonaconing, Md., mentions a few goats in his possession which, when first in milk, yield 2 quarts each per day. The foundation of his flock was gathered together in Allegany County several years ago by a gentleman upon the advice of a physician who recommended the use of goat's milk for an invalid in the family. The goats increased in number and became quite well known in that county, but they were attacked by ridicule, which proved almost fatal to the enterprise, and very few animals remain at this time. In another recent letter of inquiry about sheep in New Jersey, the facts came to light that there are about 500 goats kept by the Italian colony at Palisades Park, N. J., and that a good revenue is derived from the milk, butter, and kids. In all probability we shall hear of several other such instances, especially in the Southern States, where there may be a few goats only in a place.

In discussing the situation as it is at this time, it seems proper to mention here the efforts made by Mrs. Edward Roby, of Chicago, to bring together as many as possible of the best American milkers and to establish a flock that shall transmit the milk characteristics to their progeny; in short, she is seeking to develop an American milch goat. Her purpose is philanthropic, and is carried out by furnishing these goats at low rates and on easy terms, if necessary, to the heads of such households as are most in need of them, in order that the children may be better nourished and be relieved largely from the danger of disease that lurks in much of the cow's milk that finds its way to such households. Persons living in the suburbs who obtain one or two of these goats usually have a lot large enough for the animals and can

provide feed for them. This should insure more and better milk than that from cows which they have been in the habit of using, and they are at the same time enabled to save a considerable sum on the grocery bill.

Mention will be made elsewhere of the purebred milch goats that have been imported into the United States. These purebred animals are all from Switzerland and, with one exception, were imported in April, 1904. They are located in Ohio, Maryland, New Jersey, New York, and Massachusetts, but it will be several years before their influence is widely felt.

ECONOMY OF GOAT KEEPING.

So far as we can apply the leading features of the milch goat industry of Europe to the conditions prevailing in the United States, it can be said that the goat is needed by the poor man who can not afford to keep a cow, and by those people especially who live in the suburbs of the large cities and those who work in the mining districts. Dairies should also be conducted according to approved modern methods, so that a constant supply of milk may be had for sick people and for children whose mothers do not properly nourish them. These are matters of such importance that German writers, referring to the industry in their own country, say that the milch goat in its later development has done great service to the state, in that it supplies a want which before caused great unrest among the peasantry.

In Germany the goat plays the part in the households of poorer people, especially of the day laborers, that the cow does in the households of the well-to-do classes. Hoffmann says that the proportion of households in Germany that keep goats is 75 per cent, and that the keeping is not confined to the poorer people, but that the prosperous middle classes consider the goat of advantage to them also.

It furnishes to its owner, without doubt, the best milk for nourishing infants, for the household, for the cooking of food, and for coffee, besides butter and cheese. When one considers that it very often depends solely on the milk production of the goat whether the nutrition of the child and the whole family is bad or good, and the nutrition from infancy on has a bearing on the ability to perform a greater or a comparatively small amount of work in later life, then one will believe me when I say that the goat is in a position to wield a great influence in sustaining life.—*Deitweiler.*

Petersen, with the peasantry of Germany in mind, sums up the worth of the goat in this manner:

(1) The possibility of procuring a goat is generally within the reach of the poorest families; (2) the risk and the insurance premium are disproportionately much less in the case of the goat; (3) the goat utilizes its food better than the cow, and gives considerably more milk in proportion to its body weight; (4) the goat is satisfied with little feed, and with feed of any sort, which is to be had at much less cost; (5) by keeping two goats instead of a cow, the family of the workingman may be provided

during the entire year with milk by the proper regulation of the time of the birth of the kid; (6) the goat gives a more wholesome milk than the cow and the milk is richer in fats.

As to the question of human nourishment, the goat occupies an important position. It yields a wholesome nourishment for the family, serves as a useful and agreeable occupation for wife and children, and awakens in its owner a desire for industry and a spirit of frugality. So long as the workingman is happy in the possession of a business, has a small bit of ground to call his own, and has a profitable domestic animal, just so long will he be an opponent of social strife; a careful provider for his family, and an adherent of some recognized creed.—*Hilpert*.

In Saxony the goat plays an important rôle as the source of the milk of the household; likewise that the homes that are here under consideration belong to that class of people who are without much means. Especially in the industrial districts of the mountains, with a preponderance of the smaller manufactories, the goat is the supporter of the family—in a broad sense, of the people among which it finds its manifold uses. In this way it comes about that goat's milk is such a universally established food material, and one of which the people have become so fond, that they will pay the same price (or in many places even a pfennig higher price) for it than for cow's milk, which latter serves to help out when there is a scarcity of goat's milk. The reason for this may be found in the higher nutritive value of goat's milk, and the assertion is often made here that anyone who has become accustomed to the use of goat's milk for coffee feels it a degradation if he is compelled to be content with cow's milk in its stead, which is not so pleasant to the taste and is poorer in fat than goat's milk. But the goat is beginning to rise in prominence and gain in numbers in highly developed thickly settled districts where the people are more prosperous.—*Dettweiler*.

We had a terrible season last year and most of us lost heavily in sheep, but the goats kept us going on their milk all the time; and it was in that dry time that I overcame my prejudice and ate and relished goat meat, or, as you would call it, venison. The goats served us well until the rains came. I have just asked my girls about the flock, and they tell me they milk eighteen nannies and make from 4 to 5 pounds of butter weekly from them and have, besides, an abundance of milk for our household of seven and a hired man.—*J. R. Chisholm, Queensland, Australia*.

Such remarks as the above might be copied by the score from foreign books and journals, but those given are sufficient to show the conditions under which the goats are kept and that some of those conditions obtain in the United States and are responsible for the growing interest in milch goats. It will no doubt occur with this new industry, as it has occurred with others at the beginning, that many will enter it who will become overenthusiastic from a little success, while others, expecting much, will condemn all because of a little success only. Neither of these classes will be helpful to the industry. If a milch goat industry is to succeed in this country, it must be upon rational lines.

CLIMATE AND SOIL.

The climate suitable for milch goats is as varied as the breeds of the animals themselves. It would not be safe, in the absence of actual experience, to say that the long-haired goats are best suited to the colder climates and the short-haired ones suitable for the warmer climates only; for in Switzerland, Germany, France, Italy, Spain, and

Malta there are found both kinds, while in Syria, where there are extremes of temperature (from almost perpetual snow on Mount Hermon to tropical heat at Joppa and the Dead Sea), the goats are of the long-haired variety. The goats of Egypt, too, are long haired.

However, notwithstanding the above facts, experience with goats in the United States shows that the short-haired variety will suffer with cold if no protection is provided. The long-haired ones in the cold climates of the Northern States are almost entirely of the Angora breed, and these appear to thrive better in such climates than in the warmer climates of the South. Practically all of our long-haired goats not of the Angora breed are in the Southwest, where the climate is usually very warm, having sometime come over the border line from Mexico. So we find short-haired goats in the North, where the climate in winter is unpropitious, and long-haired ones in the South, where the long hair is not necessary to protect them from the cold.

In all probability it will be found by experience that the long-haired milch goats will thrive in all parts of the United States if proper care is given them, and that most of the short-haired varieties will also do as well; but the matter of care is of prime importance, and goats should receive the same rational treatment that dairy cows get.

All goats are alike in their aversion for cold rains and sleet storms, which are detrimental in large degree, and these conditions, where they recur often, must be considered as drawbacks. Goats do not like rain at any time, but in the warm season they are not injured by it.

The ideal locality for goats is one that is high and rocky, with an abundance of vegetation upon which they may graze and browse, but such a high location is not essential. If the air is quite dry, this makes it all the better. The animals do well on level land, provided it is not swampy and is well drained. Soil composed principally of stiff clay, so that the surface water can not rapidly percolate away, should be avoided as an exclusive pasture for goats. However, if the animals can have access to such land with a free run to higher and drier soil, it will not prove altogether objectionable. They will feed largely upon the wet land, but will seek the higher parts for rest and to sleep at night. If given such a pasture their feet should frequently be examined for evidences of foot-rot. Wet soil is more conducive to a rapid growth of the hoofs, which should be kept trimmed. This trimming is done by natural methods where the goats have access to pastures containing rocks and gravel.

A CONSIDERATION OF THE MILK.

Foreign writers almost unanimously agree in their claims as to the value of goat's milk for invalids, for children, and for cookery. Some of them regard it as most beneficial when taken medicinally for certain diseases and ailments. The claim is generally made that it is absolutely

free at all times from the germs of tuberculosis; but this is a matter which will be discussed under another head, since it concerns the animal itself as well as the milk.

There is a considerable number of sanitariums in France and Switzerland where goat's milk is advertised as a prominent feature of treatment. In these places this milk is the principal kind used in the cooking, and the patients are encouraged to drink as much of it raw as they can. The reports that come from such institutions are very flattering to the medicinal worth of goat's milk, yet, in order that too much reliance may not be placed upon this milk generally, it should be remembered that the animals in those mountainous localities must themselves surely be in most excellent health, having, as they do, the purest of air, feed, and water; and the patients, too, are no doubt greatly benefited by the same pure air and water.

The milk is specially recommended for infants because of its similarity in composition to the mother's milk; and the literature is full of instances of success attending the use of the milk with children that, previous to its use, were rapidly wasting away. The writer has in mind several specific instances of the same character which have occurred in the United States. The *Milch-Zeitung* says, however, that most authors who are assured of the complete digestibility of goat's milk, and who recommend its use above all others, base their opinions on results obtained from feeding children several months old. It is pointed out that the digestibility of goat's milk depends largely upon the action of the salivary glands, and that these glands in infants produce very little, if any, saliva previous to the cutting of their teeth. Whatever there may be in this contention its discussion will be left to the medical fraternity for experimentation. There can hardly be a doubt, however, as to the wholesomeness of the milk for children, the term being used in a general sense.

It is interesting to note here that of all domestic animals the goat is probably the best foster mother. She will readily adopt infants, calves, lambs, colts, or pigs. In some countries infants take the milk direct from the udder, and for this purpose the goat willingly enters the house, says B. R. Haddrup, and seeks the infant on the bed. Haddrup also says that the goats conceive a liking for the life which they nourish, "since they conduct themselves with extraordinary willingness toward the one who takes their milk in the matter of gratifying the whims of the suckling or of the person who milks them." With lambs they will lie down entirely when these can not reach the teats.

Below are quoted some opinions from writers upon the subject regarding the use of goat's milk:

Apart from its medicinal qualities, however, goat's milk is, for domestic purposes alone, far superior to the ordinary milk supplied by dairymen, as all who have tried

it can testify. Boiled and used with coffee it is delicious, giving the latter a rich, creamy appearance, while a few drops in a cup of tea are more than equivalent to a teaspoonful of cow's milk. When used in cakes and puddings its superiority is quickly apparent, both to the sight and taste, imparting a rich yellow color to these articles when cooked, and thereby acting economically by lessening the requisite number of eggs. Its only disadvantage for cooking purposes is its liability to curdle, which it is very apt to do if used rather old. It bears diluting well, and even when mixed in the proportion of half and half is by no means "sky blue."—*Pegler*.

Invalids for whom a milk diet is prescribed will find goats by far the best source of supply, as, besides being better in feeding power, goat's milk is very much easier of digestion than that of the cow, the reason being probably the extreme minuteness of the fat particles. For this reason, also, the cream does not rise so rapidly, and thus the milk contains almost the same amount throughout the day, a peculiarity which, while it is a disadvantage where the making of butter is the object in view, is of great advantage in cases where it is desired to use the milk in its natural state. Cream rises most rapidly in the first few hours that milk is kept; hence, in feeding an infant or invalid upon cow's milk, it will be seen that the cream will be in greater proportion at the beginning of the day, and the food approximate more to skim milk as the day advances—a variation that may be quite enough to derange an infant's digestive organs.—*Hook*.

It would seem that goat's milk, which has for so long a time been rejected on account of its odor and composition, is about to be used much more extensively. Doctor Marfan has shown that in fresh milk there are certain zymoses which are destroyed by heat. The goat's milk does not contain any more casein than woman's milk, and according to Crepin's analysis the amount of casein and butter is about the same as in human milk. Doctor Boissard, obstetrician of the Paris hospitals, published last year a report on the results given by the use of goat's milk, and the latter were favorable. There is a special establishment in Paris where goats from the French and Swiss Alps are kept. The greatest cleanliness is observed, the jugs being washed in boiled water at milking time; the milkmen are obliged to wash their hands with soap; and the bottles and milk cans are sterilized by being boiled in a solution of carbonate of sodium. It is a well-known fact that the goat does not readily contract tuberculosis, and this, of course, is a guaranty of some importance.—*The Medical Times, May, 1902; Modern Medicine, July, 1902*.

Goat's milk has the advantage over cow's milk of being free from tubercle bacilli, and can be taken quite fresh. Contrary to general opinion, the taste is not disagreeable if the animals are properly selected and properly kept, being considered of a more delicate flavor than cow's milk. The quantity of fats, casein, and salt varies greatly in the different varieties of goat. For infants and dyspeptics the weaker milk may be chosen, while the stronger answers better for debilitated subjects.—*Paris Journal of Medicine*.

Goat's milk is said by physicians here to be freer from the tubercles [germs] and more nourishing than any other milk, and hence is often prescribed for patients with a consumptive tendency. I am told that, except for the above-mentioned qualities, goat's milk is of no greater value than the milk of the cow. In fact, it is stated that the latter, when boiled, is quite as good as the milk of the goat; but, inasmuch as many persons dislike boiled milk, fresh goat's milk is prescribed instead. In French Switzerland—at Lausanne, Vevey, and other places—boys go from house to house with a half dozen goats, supplying milk as it is called for by milking the animals on the premises. * * * The Canton of Appenzell, in northeastern Switzerland, is particularly noted for "Kurorte," whence is dispensed the milk of the cow and the goat.—*Consul-General Irving B. Richman, in Consular Report, 1898*.

CHARACTERISTICS OF GOAT'S MILK.

Besides the matters of flavor and odor, which are discussed elsewhere, the leading characteristic of goat's milk is the small size of the fat globules. These are so small, according to Voelcker, that hardly any cream rises on allowing the milk to stand at rest for twelve hours or longer. Referring to certain tests, he said: "One of the samples threw up scarcely 1 per cent of cream and two others none at all on standing for twenty-four hours." This condition of the milk makes the ordinary method of separating the cream impracticable.

As to the keeping quality of goat's milk, Pegler says it is not equal to that of cow's milk, but some tests in the United States within the past year showed that there was no more difficulty connected with the keeping of goat's milk than that of cow's milk. There seems to be no reason why there should be anything inherent in this milk that would tend to cause it to "change" sooner than cow's milk; and experiments will probably show that the keeping quality of the milk of goats, as well as that of cows, depends not upon any inherent characteristic of the milk, but upon the cleanliness exercised in drawing it and caring for it.

The color of the milk is nearly always pure white. When a doe is "fresh," or has but recently kidded, there are rare instances when the milk is tinged slightly with a yellow color.

YIELD OF MILK.

The first question that most people ask concerning this industry is, "How much milk will a goat give?" A moment's reflection is sufficient to convince one that this question can not be given a definite answer. Such matters as the healthfulness of the animals, the character of feed, the regularity of feeding, the kind of breed, the age of the animal, etc., have an important bearing upon the quantity of milk produced.

A doe that yields less than a quart a day is not considered a good milker; if she yields 2 quarts a day she may be regarded as profitable, provided lactation may be maintained six or seven months. Pegler says that a doe yielding 3 pints a day with her first kid "need not be set aside as an indifferent animal, as she will, in all probability, give twice that quantity on subsequent occasions." The German literature is full of instances of goats that yield 4 and 5 quarts per day, and it appears that the average in Germany and Switzerland must be not far from 3 quarts. Indeed it is stated by German writers that many goats yield ten times their body weight of milk annually, and exceptional animals as much as eighteen times their weight.

In its form the goat exhibits, as it were, the complete type of a milch animal, and by demonstration gives annually ten to sixteen times its own weight in milk, and

considerably more even, whereas in the case of the cow we must be well satisfied with five times its weight.—*Petersen*.

The milk reaches ordinarily ten to twelve times the body weight, exceptionally eighteen times this weight, in each year. In the case of very good goats, from 4 to 5 liters^a can be produced for each kilogram of body weight, or, at the least estimate, double what a good milch cow can show for each kilogram of her weight.—*Zürn*.

If we take the live weight of a goat at 30 kilograms (66 pounds) and the annual yield of milk at only 300 kilograms (660 pounds), it will appear that goats yield in milk in one year ten times their live weight. Animals with large milk-yielding capacities can, if well fed, yield annually 800 kilograms (1,760 pounds), or even more.—*Fleischmann*.

Petersen states that one Langensalzaer goat gave 1,800 liters in one year, and that this breed has been known to give a maximum daily yield of 10 liters.

As suggested in the first paragraph on this subject, the matter of quantity depends much upon the breed. Probably the heaviest milker of all the breeds is the Nubian, which is not adapted to most parts of the United States. This breed yields from 5 to 12 liters per day. The Swiss breeds often yield 4 liters per day. Dettweiler publishes the annual yield of twenty-four goats in the vicinity of Altenburg, Geising, and Lauenstein, as follows:

	Liters.	
9 gave	600 to	700
7 gave	700 to	800
4 gave	800 to	900
1 gave	900 to	1,000
3 gave over		1,000

Ten animals in the city of Sebnitz were also reported upon, and their annual yield was as here shown:

	Liters.	
2 gave	600 to	700
2 gave	700 to	800
3 gave	800 to	900
1 gave	900 to	1,000
1 gave	1,100 to	1,200
1 gave over		1,200

It should be stated in connection with the above results that these goats were not purebred animals, but they had been bred from selected parents, which is true of most of the goats of Germany. This may indicate a policy for us to pursue in this country, where we are not so fortunate as to have many purebred animals; the two instances mentioned below, while no doubt very rare cases, nevertheless show the possibilities in this line.

Col. I. Washington Watts, of South Carolina, crossed an Angora buck upon a common doe, and thus produced a doe that gave "4 quarts of as good milk as any cow on my plantation." Elsewhere is shown

^a A liter equals, approximately, $1\frac{1}{10}$ quarts, the decimal equivalent being 1.05668.

a picture of Watita (pl. 1, figs. 1 and 2), an American milch goat. According to her owner, "when fresh she was milked three times a day and gave almost a gallon of milk per day of very good quality."

The quotations given above are from authors who write of the best breeds of goats in countries where they have done well for scores of years; but while every condition in the United States seems to be favorable to the milch goat industry, it is possible that some difficulties may be encountered. In England, for instance, the climate is not so well adapted to goat keeping as that of other European countries, and some breeds, indeed, can not exist there. One of the results in England is the reduced yield of milk. Pegler's statement below is doubtless based upon this fact:

I have received positive assurance of full 4 quarts having been reached, but, as I never myself saw a goat that gave a gallon per day, I can not vouch for the accuracy of the statement. The largest quantity I ever obtained myself was $3\frac{3}{4}$ quarts, *accurately measured*, the milking being performed thrice daily, and with the utmost regularity. I should state, however, that special feeding had to be adopted to keep up this yield, the animal being naturally a voracious eater, and with an extraordinary fondness for water.—*Pegler*.

Several of the quotations given under this head refer to the body weights of the goats, and the question will arise as to the weights of the different breeds. Wherever reliable information has been available on this matter it has been included in the description of the breeds; but it is a matter of regret that the average weights of a very few only of the breeds are to be found.

COMPOSITION OF THE MILK.

It is not probable that any two analyses of the milk of any breed would agree; indeed, analyses of the milk from one animal taken at different times of the day seldom agree exactly. The ingredients of milk are influenced by the breed, by the kind of feed consumed, by the time of day when the milk is drawn, by the particular part of the milk—whether the first or the last part—and by other minor causes. Therefore any analysis must serve only in a general way to show what the proportionate ingredients may be.

Composition of goat's and cow's milk.

[*Österreichisches landwirtschaftliches Wochenblatt.*]

Element.	Goat's milk.	Cow's milk.
	<i>Per cent.</i>	<i>Per cent.</i>
Water	85.6	87.5
Dry substance	.7	.7
Casein	3.5	3.5
Albumin	1.3	.5
Fat	4.6	3.5
Sugar	4.3	4.3

FLAVOR AND ODOR OF THE MILK.

The flavor of the milk of the goat is affected, as is the milk of the cow, by the character of feed and surroundings. The milch goat is generally regarded as a scavenger; and because it is a scavenger and thus able to secure a living and produce milk without expense to its owner, it is kept in foreign countries by those who are unable to provide feed. Most of the milch goats of Italy, of Malta, and of the Orient subsist in this way, and therefore one can easily understand how the notion has become so prevalent that all goat's milk is of poor flavor and bad odor.

The American people understand fully the causes that produce bad milk in cows, and will not expect anything radically different in the goat. If the goats are permitted to roam about the streets and alleys at will and pick up garbage, one may expect to find the milk off in flavor. In European countries the animals supplement their diet of garbage with such weeds and twigs as they can secure by the roadside and on the mountains, and this vegetation consists, to a considerable extent, of aromatic plants and shrubs. All these things have their influence upon the flavor of the milk.

The principal source of the bad odor so frequently noticed in goat's milk is the dirt which falls from the body of the animal into the milk at milking time. This may be very easily understood, and the matter of cleanliness in milking is at once suggested as the remedy. Another common source is the buck, whose skin emits the odor so characteristic of nearly all breeds of goats. Proper care is not exercised in keeping the buck separated from the does that are giving milk. It is specially objectionable to have the buck near during the operation of milking, as the milk readily absorbs the odor.

That milk when produced and drawn under proper conditions is free from ill flavor and bad odor is attested by all those gentlemen who recently imported goats from Switzerland. It is true that there is a natural taste which enables one to distinguish it from cow's milk, but it is not unpleasant.

The remedies for the objectionable features of ill flavor and bad odor lie in the proper feeds and feeding and in the management of the animals. These are subjects which will receive attention elsewhere. However, it seems desirable to quote here some opinions on these matters as expressed by foreign writers:

Many persons are impressed with the idea that this milk has a peculiar flavor, but this impression is entirely erroneous, for when drawn *clean* from an animal in health it resembles cow's milk, both in taste and appearance, the only difference being that it is richer, thicker, and slightly sweeter, containing as it does a larger proportion of sugar and cream and less water.—*Pegler*.

The milk from goats fed upon what an English meadow or roadside yields has no flavor to distinguish it from cow's milk, except, perhaps, its extra sweetness and creaminess; in short, it is only distinguishable by its superiority.—*Hook*.

An aftertaste of goat's milk, according to statements of veterinarians, should not exist, and if any such taste or smell should exist it must be traced to unclean stables or bad feed. Even cow's milk very frequently smells badly under these conditions.—*Milch-Zeitung*.

It [the milk] possesses a singular but not unpleasant sharp taste, the strength of which varies with the feeding and keeping. The better the feed, the cleaner the bedding, the better ventilated the stall, and the more painstaking the care, just so much more pleasing will be the taste of the milk. The goatish taste is always to be attributed to the lack of attention to one or more of these points.—*Detweiler*.

A scrupulous care of the skin itself is absolutely necessary, even with the best conditions of bedding. If, on the one hand, the pores of the skin, which partly serve to bring air into the body and partly to emit excrementitious materials from it, become filled with dirt and stopped up, metabolism suffers; and, on the other, the materials remain in the body, the proper excretion of which is interfered with. Thus the rather unpleasant aftertaste of goat's milk, for the most part, is to be traced to the fact that the gaseous and liquid excrementitious materials can not pass from the body because of the occlusion of the pores of the skin, and they therefore impart to the milk their unpleasant taste. The milk of healthy and cleanly goats has the same good, wholesome taste that cow's milk has, and excels it in the amount of fat and albumen contained. For these reasons it is imperative carefully to observe the following points: (1) To clean with a brush and comb—first upward, then lightly downward—each day; (2) to wash the goats with soda water or soapsuds on still, sunny days in the spring before turning them out to pasture, and again in the fall before housing them, repeating the operation a few days later in each season; by this means all vermin is destroyed and many skin diseases prevented; (3) to look carefully after the cleanliness of the udder by washing it frequently and with great care and pains.—*Kloepfer*.

It is admitted that goat's milk sometimes has the smell of the buck. Much can be done toward lessening this and toward its ultimate entire removal by furnishing a dry, sweet stall bedded with lots of clean straw, by good care of the skin, and by permitting the continuance as long a time as possible in the open air.—*Zürn*.

PERIOD OF LACTATION.

There are many conditions which have an influence upon the period of lactation, such as breed, individuality, feed, and regularity of milking. Purebred goats yield milk a much longer time than other kinds. This is owing to the fact that they have been bred with a long period of lactation as one of the leading objects in view. It is also true that individuals among all breeds excel in this particular, a fact which is not uncommon among cows. Good feed regularly supplied is a necessity to a long period of lactation, and everyone who has handled cows knows how necessary it is that the milking be done regularly if a full and constant flow is to be maintained. The same principles hold good with goats.

It may be said in a general way that the period of lactation is about seven months. The time may be lengthened in purebred animals by special effort, but with the common goats of this country the time is from three to five months. The reason for this short period is because the goats have not been bred with milk characteristics in view. All

things considered, it is best that the doe be required to kid but once a year. She should not be milked up to the time of kidding anew.

In this country, where the milch goat industry will be largely dependent for its growth for a long time yet upon selected common goats, there will probably be some difficulty in securing a period of lactation exceeding four or five months. Crossbred animals from selected common does and purebred bucks ought to lengthen the period of lactation, as well as to increase the amount of milk. There are now several purebred Toggenburg and Saanen bucks in this country, and, if they are judiciously employed to the fullest extent, their influence for a long flow and a large flow of milk ought soon to be decidedly in evidence.

Where goats have been handled most intelligently in Europe for family use, the plan is to have not fewer than two does for each family. One of these should kid in the springtime and maintain a milk flow for not less than six months, while the other should be so managed as to kid six months later than the first one and also maintain a milk flow for six months. This plan provides for a constant supply of milk, and is specially desirable if there are small children in the household.

THE OPERATION OF MILKING.

The operation of milking goats is not in essential particulars different from the milking of cows, but there are some features about this operation that should be borne in mind, and these will be mentioned here.

In some of the European countries the flock of does is driven through the streets from door to door and the milk drawn by the goatherd in quantity as ordered. This method is not recommended, as its tendency is to cause the goats to "go dry." It is said that the custom has come into vogue because the purchaser distrusts the seller, and that, even when the milking is done before the purchaser's eyes, the goatherd is often requested to invert his milk cup in order to show that it contains no water. The accompanying illustrations show such herds in Malta (pls. 5 and 6). The one who milks draws the milk while squatting behind the goat. This peculiar attitude is taken in milking, it is said, because the animal can not be trained to set her right foot back as a cow is trained to do. The English, however, milk from the side and have no difficulty in doing so.

The goat about to be milked should be placed on a box or table about 18 inches high. If she is given feed here while being milked there will be no difficulty in getting her to come to the box and remain there until the milking is done. Dr. William More Decker, of Bufalo, writing recently of his experience with his imported does, said:

The does will come to the milking place as soon as the door of their pen or barn is opened, in expectation of receiving their mess of oats. Last summer I milked three

does and each would come in turn as soon as the door was opened. They were given oats in a large measure. The first was allowed to eat until she was milked, when she was returned and the next doe was at the door ready to come out.

Sometimes it happens that a young doe will object vigorously to being milked, and in such cases it has been found necessary to secure the animal by the head. A frequent practice is to use a contrivance called a guillotine fastener, or guillotine board. This consists of two boards with half-round notches, which when placed together fit around the goat's neck. The lower board is fastened securely in position, while the upper one may be moved up and down so as to admit or release the doe. Other methods will suggest themselves to people who are accustomed to milking cows.

Under no circumstances should milking be done in the stalls or in the barn where the stalls are located. The buck should not be in the place where the milking is done, or so near that his odor may be detected, for, as stated in another place, the milk is very ready to absorb this odor.

Regularity of milking should be maintained. When the does are in full flow, they should be milked three times a day; for if not, the udder will become so distended as to be exceedingly painful and the flow will decrease rapidly. A disregard of this point is apt to render futile all other efforts in the way of breeding, feeding, and care.

Kindness and gentleness are now recognized necessities in the best cattle dairies. These characteristics are even more necessary with goats. On this point Von L. Albrect is quoted:

Milch goats will be particularly gentle and of kind disposition when handled and cared for, so far as possible, by the same person. To this end, the milking must be done with regard to gentleness and regularity, and with the closed hand so far as possible. The strokes and tugs must be performed with care. The milking is done best by a stroke directed from above downward.

The following practical remarks by Renesse deal with the general subject of milking:

Before beginning to milk, the two teats are to be washed off with lukewarm water and then dried off with a soft cloth, also the udder is to be stripped a few times from above downward. It is advisable that the animal be milked by one and the same individual, with clean hands, at regular and definite times. The milk pail is to be entirely sweet and clean. Milking must not be done in the stall. Tuberculous persons must not be allowed either to expectorate in the stable or, much less, to milk. That the milk may not depreciate in taste, it should be put away in a suitable place. A statement of the amount of milk given daily should be kept in a book by dates, in liters, in order to have an accurate account as to the profit.

TRANSPORTABILITY OF THE GOAT GIVING MILK.

Another feature about the milch goat that is advantageous is that, in the case of a sick person or an infant traveling, the goat may very easily be taken along on the journey for the purpose of furnishing

milk. This is a frequent practice in England and is not entirely unknown in our own country. This custom will enable a person to enjoy a change of climate and still keep his regular supply of one kind of milk, both of which are conducive to health. It is well known that with infants a change of milk from one cow to another will oftentimes produce disorder in the system, and, of course, it is not practicable to take a cow along, "as one of the family," as the goat can be taken.

If the experience to be gained in the United States shall confirm all the claims made for goat's milk in Europe, there is a suggestion in the above that is worth considering. In the summer season there is an exodus from all of our larger cities of a considerable number of people who seek temporary locations in country places or in the mountains, and among them are hundreds of mothers with infants requiring pure milk and pure cool air. If such resorts should maintain a flock of goats for the benefit of such children—or for other people, if need be—the resulting benefits would be greatly enhanced. Inquiries as to the existence of just such places have been received by the Bureau of Animal Industry, and the idea of their establishment seems practicable.

GOAT DAIRIES.

The question is raised in the paragraph above as to the advisability of keeping goats at mountain health resorts, and here the question will be raised as to the probable value of a goat dairy. Since there seems to be an almost universal indorsement of goat's milk for children and sick people, we may well consider the advisability of the establishment of dairies for supplying the city demand for the milk. Inquiries from physicians of various cities are already sufficient to justify the belief that there is such a demand. The cost of a small dairy need not be very great, and it might be worth the while of physicians to lend such an institution their moral support.

The price to be obtained for the milk will depend largely upon circumstances. In a few instances where some has been sold, the prices ranged from 12 to 25 cents per quart. At this writing the milk of goats in the vicinity of Palisades Park, N. J., is selling for 12 cents per quart. In this case the milk is not used for hygienic purposes, and most likely it is not produced and cared for according to recognized sanitary methods. Better prices will probably obtain where the milk is properly produced for consumption by puny children and sick people.

If such dairies are established and prove successful, other matters of development will demand attention, such as the manufacture of cheese and condensed milk. A few remarks on cheese are given elsewhere, and only a sentence will be given here with reference to condensed milk. Goat's milk in this form is already found in the markets of

Europe, and there can be no question that it will fill a want where it is not possible to obtain the milk in a fresh state. It should supplant entirely the use of such milk from cows, which is now used by thousands of infants during the first few months of their lives.

GOAT'S CHEESE.

It does not seem practicable to include much in this paper regarding the manufacture of goat's cheese. If it shall appear later on, after the establishment of goat dairies, that the manufacture of cheese should be undertaken, the matter will then no doubt be discussed by some one who is familiar with all the processes, which is not the case with the present author. Nothing further will be attempted here than a few general remarks, in order that those who are uninformed on the question may know that the manufacture of cheese from goat's milk is a very important one in Europe.

The cheese that is made from goat's milk is considered very choice and always brings good prices. Some of the varieties quite well known in the United States are the Roquefort, Ricotta, Schweitzer, and Altenburger. It is stated that on an estate near Lyons, France, 12,000 goats are kept in flocks of 40 to 60 for the purpose of cheese manufacture.

The goat's cheese made in the vicinity of Mont d'Or, France, near the Swiss border, enjoys a world-wide demand, and there are employed at this place about 15,000 goats. We are informed that the annual production of cheese there is valued at 1,500,000 francs (\$289,500). The French goat's cheeses worthy of special mention are Fromage de St. Marcellin, St. Claude, Cheveretin, Gratairon. The first one is a combination of the milk of the goat and the sheep, which also is the case of most Roquefort cheese.

The strong taste and odor of goat's cheese are qualities very pleasing to many. In Norway a goat's cheese called Hoitcost is quite a favorite. On this account the French, German, Dutch, and Swiss dairymen, especially the last two, have been in the habit of making cheese of an especially pronounced odor and flavor, and, in pursuit of this habit, some of them have used the milk of the goat in part with that of the sheep and the cow in the making of cheese; but while in some instances the milk of the sheep is used wholly for a special kind of cheese, that of the goat is only used when mixed with the ewe's or cow's milk, simply for the purpose of securing the special flavor of it; and, as the special kinds of cheese thus made find a market in our large cities to considerable extent and at high prices, it is quite probable that the making of this kind of cheese may become an established and quite profitable industry; and, in fact, in view of the great enterprise and ingenuity of the American citizen in all the business of life,

it may easily become so to an enlarged extent when goat's cheese shall be offered in our markets.

With reference to the manufacture of goat's cheese, Renesse gives the following:

The milk is treated in a kettle warmed to 25° to 26° R. [or 88° to 90° F.], and, while being stirred evenly, is brought to coagulation by the addition of rennet. By this means the so-called curd is separated out of the whey. The curd is then manipulated with a strainer and the whey allowed to run off. When the curd after several hours has become dry, salt and caraway seed are intimately mixed with it and it is made into small cheeses. These little cheeses are to be placed on racks in the cellar to dry and are turned daily. After about fourteen days they are ripe and ready for use. The cheese takes on an especially fine taste and sweet odor if, after a long period of ripening, it be laid in the dried leaves of the sweet-scented woodruff. As a rule 1 kilogram of cheese can be obtained from 10 liters of milk.

GOAT'S BUTTER.

It is not deemed worth the while or the space to say very much here about goat's butter, for at best it is said to be a very poor substitute for the article made from cow's milk. In the Orient, especially in Syria, goat's butter is frequently but not extensively used. It is served to American and European travelers in that land and they find it almost unbearable. The cream rises upon the milk very slowly because of the smallness of the globules of fat, as has been explained before, and therefore in order to secure practically all of the cream the milk is permitted to stand until it becomes thoroughly soured. Very little effort is made to keep the milk free from dirt, and consequently the long period of setting intensifies the injurious effects of the dirt.

Some of the characteristics of the butter are its whiteness and softness. Very rarely it has a yellowish tinge. The taste is said to be pleasant if made under modern sanitary conditions, yet it is inferior to cow's butter.

Composition of goat's butter.

[*Milch-Zeitung*, 1893, p. 756.]

Element.	Per cent.
Water	8.2
Fat	86.5
Salts and ash	3.7
Proteids	.9
Carbohydrates	.7

GOAT'S WHEY.

Goat's whey is highly recommended by foreign authorities for its medicinal and nourishing properties. Zürn says it is recommended especially for diseases of the lungs and for anemic persons suffering

from innutrition. As this feature of the milch goat industry is not likely to become a matter of importance in this country for some time yet, nothing further will be given here except an analysis, as below:

Composition of goat's whey.

Element.	Per cent.
Fat	0.02
Sugar	4.989
Salts	.665
Albumin	.581
Water	93.766

IMMUNITY FROM TUBERCULOSIS.

Some writers state with great positiveness that goats are absolutely free from tuberculosis and therefore the milk from goats can not be affected with tuberculosis germs; others state, however, that this claim is too strong to be borne out by the facts. If the claims of the first class were strictly true, it could well be said that the goat would not only be a real boon to humanity but would also be the most useful of all domestic animals. It will probably never be known just how many people contract tuberculosis by drinking the milk of tuberculous cows, but it is well known that the number is considerable. It is quite generally agreed at this time that this disastrous disease is acquired rather than hereditary, and that one source is milk from diseased cows. Renesse says, in discussing the advantages of goat's milk, that "In Germany 100,000 people die annually from consumption, and the number of those sick from the disease is estimated at ten times this number." In all probability the death rate from this disease is just as large in most other countries. If all this be true, surely all efforts are dignified that have for their object the eradication of tuberculosis. If goat's milk is really helpful to the attainment of such an object, it should be given the most extensive use. Milk is the first food of man, and he is dependent upon it, to a large degree, throughout life.

It will not be out of place to suggest here that that freedom from tuberculosis, which is so often asserted, is due to the feed and climate where the animals are found and to the exercise obtained in roaming over the mountain sides. It may be that when confined in close quarters with cows that have tuberculosis the goat will also contract the disease; in other words, its freedom may be due to environment rather than to a physiological immunity.

It is not the purpose of the present writer to enter into a discussion of tuberculosis. That matter will be left to the medical fraternity. The purposes of this paper will be subserved by giving some of the opinions of foreign authors, in order that we may know what thought is being given to the subject abroad.

A German agricultural paper indorses goat's milk because of its "antitubercular properties, insuring a pure milk yield;" and the paper continues:

Since Löbe, Rhode, and others ascribe to goats an almost total immunity from tuberculosis, Koch makes the statement, in his first study concerning tuberculosis due to infection of cow's milk, that recently there are well-authenticated cases recognized in the literature due to inoculation by cow tubercles or in consequence of rearing goats on tuberculous cow's milk.

Hilpert says that since the goat is much more healthy than the cow and sheep, tuberculosis (which can be transmitted from them to man) attacks it very rarely, and so its milk is very much better and is especially adapted to children.

Renesse says, with reference to the milk of the goat, that there need be no "fear as to the transmission of tuberculosis."

Doctor Schwartz, medical counsellor from Cologne, in an address at Frankfurt (1896) before the Association of German Naturalists and Physicians, directed the attention of the convention toward goat's milk as a food for children because goats rarely have a tendency to tuberculosis, and even when they have it they become infected by coming in contact with tuberculous cattle.

While the statement is not entirely true that goats are absolutely immune from tuberculosis, yet of 1,500 goats publicly slaughtered in one year only 0.6 per cent were affected. This bears no comparison to the prevalence of tuberculosis among cattle. For example, in the slaughterhouse at Kiel, Germany, in 1896, 41.03 per cent of all slaughtered cattle and 45.82 per cent of all cows were found to be tuberculous.—*Hoffmann*.

Undoubtedly the most important of all the qualities of goat's milk, especially in its relation to its adaptability to the feeding of infants, is its immunity from the danger of carrying the germs of tuberculosis.—*Hook*.

In the Kingdom of Saxony, according to a report concerning veterinary affairs for the year 1894, it is stated that out of 1,562 goats slaughtered only 10 (0.64 per cent) were found to be tuberculous, of which 2 were destroyed, 1 was kept under observation, and 7 were found salable. In Prussia, in 1899, in 381 slaughterhouses 47,705 goats were killed. Of this number only 148 head (0.41 per cent) were infected, either generally or locally. This result must be the more astonishing because the goats, with only a few exceptions, were kept under conditions eminently favorable to the spread of tuberculosis. Petersen, quoting these same figures, says that the goats ran freely in the cattle sheds, ate out of the racks with tuberculous cows, and, owing to the well-known proclivities for mischief, took hay out of the mouths of the cattle, whereby they exposed themselves to the greatest possible infection.—*Dettweiler*.

Assistant Eichhorn informs us as follows in Report of Veterinary Science in Imperial Saxony, concerning the appearance of tuberculosis in goats: "There was a goat (in a large herd of 28 head) which had been brought for treatment and which after its death, which soon followed, was found to be tuberculous to a high degree. This made it imperative to inoculate the remaining 27 head with tuberculin. In 18 of these, in consequence of the inoculation, a rise of temperature occurred of 1° to 2.5° C., and only in 9 did the increased temperature amount to less than 1° C. (0.6° to 0.9° C.). Because of this result 68 per cent of all the goats had to be retained

on suspicion of being tuberculous, and only 32 per cent were to be looked upon as probably free of tuberculosis. The owner could only make up his mind to have 3 slaughtered, of which 2 were suspected of being tuberculous and 1 was probably free of the disease, the result justifying the conclusion that the diagnosis was correct. This shows that a greater degree of care is necessary in the use of goat's milk as food in the milk cure."—*Deutsch Landwirthschaftliche Presse.*

MANAGEMENT OF THE GOATS.

The buck.—The management of the buck is of the utmost importance if it is desired to conduct the goat business along definite plans. If carelessly managed he will upset all plans. It must be remembered that the male of all breeds of goats, except the Angora breed, is in heat at all times, and that the doe comes in heat about every three weeks, except during the months of July and August. This means that if the buck is allowed to run with the does the kids will oftentimes be coming at the most inopportune seasons, which is not at all desirable. If milch goats are to be kept for family use or for dairying, it is necessary that breeding be done according to a schedule, so that a constant milk supply may be had throughout the year.

Besides the objection to breeding at the wrong season, there is the further objection of breeding the does too often. Usually, if not restrained, most milch goats will breed twice a year, and sometimes it occurs that kids will be dropped three times in one year. This is putting too much strain upon the does, and the best results can not be obtained by the practice.

The buck should always be kept away from the does except when desired for service. By this practice he may be kept in better condition on a less amount of feed than if allowed to run with the does all the time. His presence in the goat barn, especially if milking is done there, is very objectionable. The strong odor which he emits will readily be absorbed by the milk and is the principal source of this odor. His place is in a separate barn and yard and pasture.

Best results are obtained where the buck is always in good condition. It may be necessary to feed him some grain in the winter, but it should not be enough to make him quite fat. He will thrive better and have a more kindly disposition if he is frequently brushed thoroughly.

The doe.—The fact that a doe may be bred to drop her kids at almost any time desired is one of her advantages as a milk-producing animal. If two or more goats are to be kept for household use, it is desirable that there be a constant supply of milk; and, in order that this supply may be produced, the does should drop their kids from four to six months apart.

If a household is to be furnished with goat's milk, matters should be so arranged that this supply may be fairly constant. As one goat

is not capable of furnishing this supply for the entire year, two or three goats should constitute the basis of the household supply.

The matter of feeding is discussed elsewhere, but it should be stated here that goats in lactation should be fed in the same manner that dairy cows are fed. The feed that will produce milk in the one will do the same in the other.

It is surprising how much butting and knocking about a doe can receive without injury even up to within a short time before kidding;

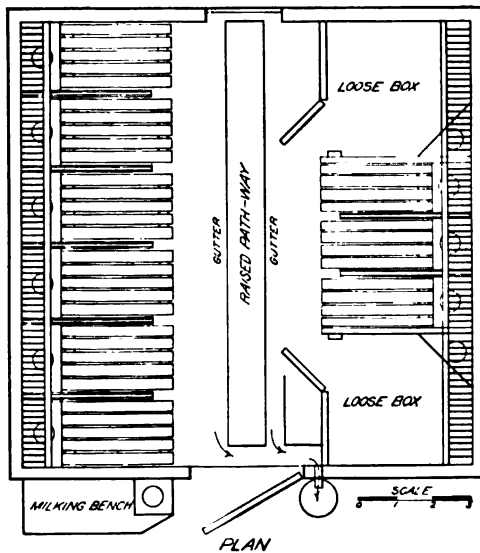
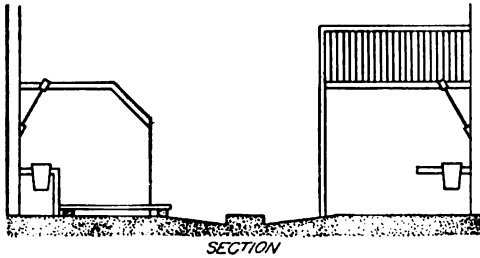


FIG. 1.—Plan of goat house. (Copied from Bryan Hook.)

dairy cows; how much more should be demanded of a goat? The goat dislikes rain and mud, and will avoid contact with either if possible. While warm rains do not prove injurious, cold rains, sleet, and mud are very detrimental to grown goats and are almost sure to cause death in the very young kids.

The principles that should be observed in constructing a goat barn are the same as those governing a dairy barn. The matter of ventilation is of special importance; for there is no domestic animal that

but it will always be unsafe to leave the does among the other goats too long after they show evidences of pregnancy. Two or three weeks before the kids are due it is well to shut the does away from the other goats. If she is kept in the barn she should be loose in a pen or box, as shown in figure 1, and kept there until the kids come. Her future handling will depend upon the disposition to be made of the kids. (See "Raising the kids," p. 40.)

THE GOAT BARN AND YARD.

The goat barn is a necessity, though very inexpensive expedients may oftentimes answer. No one need expect to obtain a heavy flow of milk from does that are compelled to endure all sorts of weather. Everybody knows this fact in connection with the keeping of

suffers so much as the goat when it is deprived of an abundance of fresh air. There should be plenty of light, and the sun should be enabled to shine in. If there is an abundance of room for the animals, all the better; crowding is always detrimental.

The better barn is one that has a loft above, where the hay is stored, and this hay can be fed into a manger or rack from above. The rack is better in many respects. The hay in it is easy of access, and not so much of it will be spoiled by the goat as when it is in a manger where the entire lot may be mused over. Below the rack a board is fitted across the end of the stall, and through this board a hole is made for holding a pail or other similar vessel containing feed. The advantage of this is apparent. This board should be strong, as the animal will use it as a footboard in order to reach the higher for hay in the rack above.

The stalls are usually from 2 to 2½ feet wide, and the partitions between the stalls extend back about two-thirds the length of the goat. This length is sufficient to keep the goats from interfering with each other when feed is given. Each stall should have a floor raised slightly above the earth. This floor should be made of narrow pieces of lumber, and a space left between the pieces so that the liquid manure may pass through and away. It should extend beyond

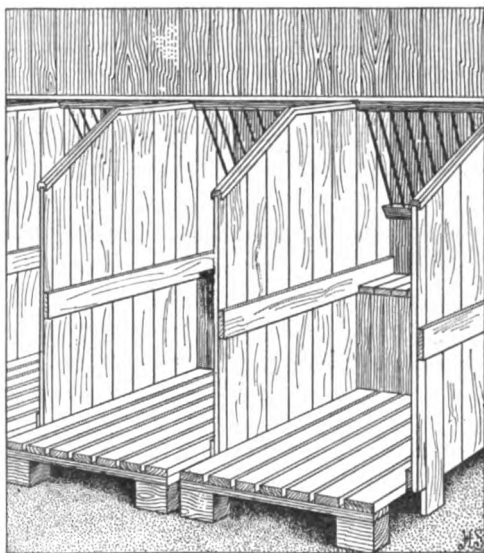


FIG. 2.—Suitable goat stalls. (Copied from Bryan Hook.)

the partition so far that the goat when tied in its stall will not step off.

The illustration given herewith (fig. 2) is reproduced from Bryan Hook, and seems to answer all the purposes of a satisfactory barn. The "loose boxes" shown in the two corners of figure 1 are for the kids or for does soon to kid. Attention is also called to the milking bench on the outside of the barn. If desired this bench may be under cover, but it is always well to do the milking away from the stalls and the other goats. Some goatmen build their platforms in the stalls about 18 inches high and then milk the goat there, but this is not the best plan if it is desirable to obtain milk that shall be free from bad odor and bad taste.

I give herewith a plan of one of my own houses, the arrangement of which I have found to work well. It is designed to provide the greatest amount of accommoda-

tion in a limited space, the inside measurement of the house being 12 feet square. The building is of wood, lined inside, and the intervening space packed with straw and shavings; thus it is seldom that frost can effect an entrance, a point of some importance if it is desired to obtain milk in winter. There are six 2-foot stalls on one side, and on the other three 18-inch stalls, and two loose boxes, the latter to be used for goats that are expected to kid or for shutting kids away from their dams.

The upper part of the loose boxes is made—as are also the hayracks—of $\frac{1}{2}$ -inch iron bars. Down the center of the house is a raised path with gutter on each side, so arranged that the liquid manure is discharged into a pail, as shown by the direction of the arrows. The milking bench is in the open air, but is protected from rain by the eaves of the thatched roof. This bench will be found a very necessary piece of furniture, for though the animals can be milked in their stalls, the operator will be apt to find the stooping posture extremely irksome. If this bench, about 18 inches high, is placed in some convenient situation and fitted with a manger in which the goat's ration of corn or meal is placed, she will require very little training to mount it willingly the moment she is released, and in this position the milking can be done with comfort. Even a young goat that has never been milked before will learn in a few days to stand quietly, and my friends have often enjoyed a hearty laugh over the alacrity with which each in turn scampers round to the milking bench as its chain is unfastened.—*Hook*.

A good yard should be connected with the barn, where the animals may get air and exercise during the day if they do not have the run of a pasture. It is also a good plan to have an open shed in this yard, where the animals may go to get out of storms or out of the sun's heat. If there are platforms about 18 inches or 2 feet high in the shed and the yard, they will prove a matter of great pleasure to the goats, which will nearly always seek such places when they desire to lie down.

Feeding should not be done in such yards, as the goats will be certain to fight, and it will often happen that serious injury will be done to kids or to does about ready to kid. If all feeding is done in the stalls in the barn, the goats will always be ready to rush in as soon as the door is opened, and each one will go directly to its own stall, where it can eat in peace and at the same time get all that is due and no more.

BEDDING IN THE GOAT BARN.

The goat never seeks the soft places. If given its choice of a place to sleep, it will choose a rock on the highest point in reach. A bed is not one of its requirements, and is in no way conducive to its comfort; but it is desirable that some form of litter be provided, such as chaff or sawdust, for the sole purpose of absorbing the liquid manure that does not pass below the slatted platform in the stall. Straw may be used for the same purpose, but the goat is liable to clear it away by pawing. Sawdust, although a fairly good absorbent, does not make good fertilizer, and it should not be used if the stall cleanings are to be preserved for fertilizing purposes; it is, too, in most places, likely to cost more than other forms of litter.

FENCES.

In opening the discussion of this subject the reader must be assured that the goat is not the worst animal in the world to jump fences, as it is so often charged with being. It may easily be trained to jump a fence of considerable height, but ordinarily it will not attempt to jump a fence that is over 3½ feet high. The goat is naturally a climber, and it will amuse itself in walking the top of any fence that offers an opportunity for it to get there—such fences, for instance, as the old-fashioned “worm” fence, with supports sufficiently slanting to enable the animals to walk up them. If there is just a single place where the goats may climb upon the fence, depend upon it that the whole flock will find it, and never forget where it is.

However, goats can not climb a fence that is straight up and down, neither will they be inclined to jump it; therefore, experience has demonstrated that a fence that is 3½ or 4 feet high is sufficient to restrain these animals. This fence may be made of wire or boards or rails. If it is made of wire, it should be the woven wire, with squares, or meshes, so small that the goat can not put its head through. This precaution should be specially heeded where there are goats with horns, as with the head once through it can not get release without assistance.

The value of any fence for goats, sheep, or cattle is greatly enhanced by a strand of barbed wire about 8 inches above the fence. It tends to discourage all attempts of the animals to get out, and wandering dogs are not inclined to try to go over it.

The fence should be built close to the ground, and care should be taken to see that no opening of consequence is left anywhere, for the goat will crawl as successfully as it will climb, and it often astonishes people by its success in crawling through small openings.

SALTING THE GOATS.

Goats are very fond of salt, which serves its purpose best when given properly. While some prefer to provide loose salt at regular intervals, the usual practice is to place a lump of rock salt in a place easy of access, where the goats help themselves whenever they desire to do so. If goats are accustomed to the use of salt, they will not take too much of it; but, like other ruminants, they are likely to overdo matters if they have free access to an abundance after a period of deprivation. The writer has in mind instances where Angora goats have been killed by a too liberal supply of salt after having been deprived of it for some time.

WATERING THE GOATS.

Goats are not regarded as very great water drinkers, but when in milk they should be enticed to drink as much as possible. The water must be fresh and pure, else it will be avoided by the goats until thirst compels them to drink it. In the winter season it will be well to give it slightly warm.

CARE OF THE HOOFS.

Where goats have access to a pasture containing gravelly or rocky soil, their hoofs will be kept worn down by natural processes; but where they are confined in barns and small inclosures, the hoofs will grow to great length, and will interfere to a considerable extent with the movement of the animals. In this condition the hoof will catch and hold between the toes a large amount of dirt, which makes the parts sore, and more subject to foot-rot than when the hoof is in good condition. It is not difficult to keep the hoofs in proper condition, and, since it is necessary, it ought to be done.

FEED FOR MILCH GOATS.

All of the foreign writers on the subject of milch goats devote considerable space to the methods of feeding and kinds of feed, but, owing to the very different conditions prevailing in this country, their experiences can be adopted in a general way only. The principles governing the feeding of milch goats are the same as with dairy cows.

It will be very natural for those people who have been reading about the Angoras and their ability to destroy worthless brushwood and weeds to think of the suitability of such places for milch goats. These goats have the same appetite for twigs, bark, and weeds that the Angoras possess, and such feed may be regarded as desirable for growing animals, but when the does are in milk a sole diet of such feed is very likely to impart an unpleasant taste to the milk. Besides the unpalatability of the milk from such feed, so large a flow can not be expected as when grain in some form is fed in addition to the browse. The milch goat is a single-purpose animal; she can not produce milk satisfactorily and at the same time destroy brushwood and weeds to a large extent.

Pasturage is highly recommended by the English goat men when the pasture is large enough to really afford a change of diet, but they agree that a small pasture—such, for instance, as an acre for two or three goats—is very undesirable. They say that it is their experience that in such small pastures the goats are so often passing back and forth in their former paths that they tire of the feed and will soon show a lack of thriftiness, and death follows in a year or two. The goat prefers to wander over a large area and to gather its food in a

variety of bits here and there, and therefore a large pasture is quite desirable. However, what has just been said about such feed as a sole diet must not be overlooked.

It is a common statement that eight goats will subsist upon the amount of feed required for one cow and at the same time yield a good flow of milk. Many actual tests made in Germany are cited to prove this. Where browse is afforded as a supplementary feed 300 pounds of hay is a sufficient quantity for a milch goat annually, but in an examination of experiments where large milk production was the object in view it has been shown that some goats will consume as much as 700 pounds annually. It will be well for Americans to estimate the amount required at 500 pounds at least, since we are not so careful to prevent waste as the people of Europe. If permitted, goats will waste much hay by pulling it down underfoot; and as they are very particular about their food, they will eat nothing that is soiled or tainted.

Without hay or good, dry fodders goat keeping for milk is scarcely possible; this class of feed can not be displaced by any other. Good hay, such as the goats relish, is preferable to coarser fodders. Clover hay probably has no superior as feed for goats. It exercises a stimulating influence upon the digestive organs and serves as an active element in the production of milk. Fresh hay, which has not undergone the sweat, is difficult of digestion and easily induces bloating. Old and musty hay becomes repulsive.

Such roots as mangolds, carrots, swedes, Jerusalem artichokes, parsnips, potatoes, and turnips are regarded as excellent feed. The goats prefer the turnips. All roots must be washed perfectly clean. A common method of feeding in England is to cut the larger roots into halves and place them with the cut surface uppermost in the bottom of a pail. The goat will then work at the pieces until all the inside is completely eaten, leaving the rind. The animals seem to enjoy doing this work. It is advised not to feed the mangolds earlier than Christmas, as when fed soon after they are pulled they are likely to produce scours.

Elsewhere, under the head of "Flavor and odor of the milk," there is some discussion of the influence of garbage upon the milk; but those remarks apply especially to that garbage which is decaying and filthy and which is eaten by the goats because of necessity rather than from choice. Clean and fresh refuse from the kitchen and table, such as potato and turnip parings, cabbage leaves, and crusts of bread, are readily eaten.

In feeding grain the same judgment must be exercised as when it is fed to dairy cows. It must be of the proper kind and not fed in such quantities as to produce fat rather than milk.

Bran is considered a most excellent feed, but its use, of course, will

depend upon its cost. The daily ration of this feed will vary between one-half and three-quarters of a pound. It will be well to dampen the bran with a little salt water. Malt is recommended by some, where it can be had regularly and at reasonable cost. It is an excellent milk-producing feed, but it should never be fed sour.

Oats are specially good for goats that are dry and for kids. From one-half pint to one pint a day will be sufficient. Corn is preferred by Pegler for goats in milk; not over a pint a day should be given. He says that when it is mixed with pease or beans it forms capital food. Corn is the most abundant grain feed in the United States, and therefore ought to be of great assistance in the development of a milch goat industry. Meal, oil cake, and linseed cake are highly favored. Of the latter Kloepper says: "It is absolutely invaluable before delivery, when, on account of its digestibility and ready assimilation, it is a prophylactic against milk fever." In giving oil cake and linseed cake, it should be broken into small bits.

Some remarks on the feeding of various substances are copied herewith from foreign writers:

From my experiments, which I have conducted in the past two years upon my experimental animals, one must figure on at least 3 hundredweight of hay yearly for each mature animal. If one can obtain more, of course it is so much the better. As a means of saving the hay it is suggested that it be cut up and be fed in a narrow rack and mixed with straw. By this means the animals will be prevented from tramping the feed under foot. It is best in the morning to feed half of the day's ration of hay, mixed with equal amount of straw, and after this to give water which in severe weather has been allowed to stand in a warm room or in the kitchen. The offal from the kitchen serves as the usual noon meal, which should be given not with, but without, a large amount of liquid.—*Kloepper*.

Hay is best supplied in its entire state, but may be cut up into chaff and mixed with the provender. As, however, this requires the use of a chaff cutter, which it is not worth while to purchase merely for goats, it will be generally given as hay and not as chaff. Bulky food like this serves the purpose of filling the stomach, which requires a certain amount of distention to enable it to perform its functions properly. To effect this with corn alone would, in the first place, be expensive, and, secondly, so large a quantity of concentrated food would be injurious. In fact, hay or chaff in conjunction with corn may be regarded in the same light in the diet of a goat as bread and vegetables combined with meat in that of man. There are two kinds of hay—meadow hay, composed mainly of grass with a few herbage plants, and clover hay, made with that plant alone. The latter is generally preferred by goats, but the former is considered best for milch goats, besides also being cheaper.—*Pegler*.

It seems to be the general practice to house goats during the night and, except in the middle of summer, it is probably best to do so. They will need some food during the night—a small armful of grass or some leaves, while, if they are in milk, a few oats, say half a pint, will be an advantage. Kids should have some oats every day if they are wanted for stock. In the winter some linseed cake is of great use, and roots will have to be used—carrots, swedes, and mangels; the mangels ought not to be used before February or March. The tops are good food. All roots should be washed. A certain amount of hay must be given, but in small quantities at a time or it will be thrown down and wasted.

In stall feeding the food will be much the same. It is best given in three meals, at regular times, but the food should be varied as much as possible. This change is of great importance. A moderate-sized garden will supply most of the food required for one or two goats in the shape of waste products, such as the thinning of carrots and turnips, the spare young cabbages for which there is no room, the lettuces that have bolted, any weeds and hedge clippings, together with potato and apple peelings and dry crusts of bread from the kitchen, all kept very clean.—*Soames*.

Opinions differ as to the proper time to feed. Some favor two times a day and others three times a day. The best results from hay are when there is an abundance, and there should be some in the rack at night.

CONCERNING DISEASES OF GOATS.

It is said by those who write from experience that goats are not subject to so great a variety of diseases as sheep, but those diseases which do attack them are in the main the same as attack sheep.

For various reasons, principally because of the limited experience with goats in the United States, it is deemed wise not to enter upon a discussion of diseases that might occur. Most farmers know quite well how to handle animals with minor troubles, but conditions that become serious should call for the services of the veterinarian.

Let the owner of goats keep ever in mind that prevention of disease is nearly always easier than a cure. Given a healthy goat, provided with good feed and water, plenty of fresh air, and proper housing, we have the conditions that do not tend toward disease.

THE MATTER OF BREEDING.

The buck.—With milch goats, as with any other breed of domestic animals, it is very essential that the best buck possible should be employed. Not only should he conform to the recognized type for his breed, but it should be ascertained whether he is from a strain having well-known milking qualities. If his sire is of the proper breed and his dam a good milker, the chances are that he is a good animal from which to breed. In fact, records of the amount of milk given by the dam, granddams, and other near female relatives of bucks should be available and the selection of males should eventually be based largely on this evidence. These records are not difficult to make in flocks which are being carefully bred. There is nothing so important in breeding as evidence that the whole family is good in performance. Always avoid what are usually referred to as "common" bucks.

The number of does to be served will depend very largely upon the management of the buck. His age and constitution, as well as the character and quantity of his feed, have an important bearing upon his powers of reproduction. If the buck is allowed to repeat service several times for one doe, it is apparent that a smaller number of does

can be served than if there is one service only. When carefully managed, one buck is sufficient for a flock of fifty does.

The following description is from Pegler:

A he goat should have a small neat head with plenty of beard and neck short and thick, with abundance of hair. The horns may be large, but not too coarse and heavy. The chest should be broad and massive, the back long and straight, and the ribs well rounded, the tail being placed high up on the hindquarters. These are required to be as square as possible, the reverse being the most common failing of he goats. The legs must be straight, thick, and strong, and well covered with hair on the thighs and buttocks.

The doe.—In a measure the same characteristics possessed by the buck should be prominent in the doe. She should be of a milking strain and at the same time have the other recognized qualifications for milch goats. For convenience most foreign breeders prefer hornless goats of solid colors, but while horns and long hair may be regarded as nuisances, these features really have no influence upon the quality or quantity of the milk. It is obvious that an animal with short hair is more easily kept clean than one with long hair.

The animal should present a lanky appearance, with broad muzzle, clean-cut head, graceful neck, large in the stomach. The chest should be deep and broad and the height should be equal at the shoulders and the hips. The udder is hard rather than soft and fat. Sometimes a fat udder is mistaken for one of large milk capacity. The size of the udder varies with the length of time since kidding and also with the number of times she has kidded. It is not uncommon to see the does of pure breeding have teats that touch the ground as they walk about, especially among the goats of Malta, Spain, and India. Occasionally there are found individuals among common or crossbred goats that have udders that nearly approach this size.

The following description is by a German writer of much observation and experience:

In a good milch goat the following points are to be described: A long body, growing larger at the hinder parts and beneath, neatly rounded form, a deep and broad breast, short legs, broad buttocks, wide but filled out "hungry hole" (the depression in front of the hip bone), a neck that is not too long nor too thick, a light, broad head, wide mouth, and good udder. The udder should be of considerable size. Only those goats can give plenty of milk which have a bulky, well-developed milk gland; that is, a large udder. But it is not always the case that a capacious udder signifies a high milk yield. The amount of glandular tissue in the udder can be augmented by the surrounding flesh and fat, and then the udder is spoken of as a fleshy or fatty udder. A large udder is, then, a favorable sign of an abundance of milk when it is a genuine udder. A fatty udder feels soft and full; its skin is generally somewhat thicker, sparsely covered with long, coarse hair; does not wrinkle after milking and diminishes only slightly in circumference. A genuine milk udder feels tight and as having kernels in its upper portion; its skin is thin and tender, covered with short, fine hair, and forms very perceptible folds and wrinkles, which fall together after the milking is done, if the condition of the udder is not too tense.

Moreover, the blood vessels course along very noticeably on account of the thin skin when the udder is filled—a condition not present in the case of a fatty udder. A good milch goat should have a fine, thin skin, which is best examined over the ribs, and it should be covered with fine (not bristly), smooth, glistening hair. That the absence of horns possesses an alleged influence in making the milk mild in taste has been spoken of before. When all these characteristics coincide it is certain that one is dealing with a good milch goat.

THE BREEDING AGE.

There is probably no other domestic animal that is liable to breed so young as a goat; but, as with other animals, to permit very early breeding is to dwarf the doe, and consequently render her almost useless as a good milker. If a doe is bred at the age of 1 year she will drop her kids five months later, which is young enough if the purpose is to produce a good milker to last through several years. A buck may be put to light service at the age of 1 year, but results are more satisfactory if he is not bred till from 18 to 24 months old.

The period of gestation in the doe is about five months (from 147 to 152 days), the same as with sheep. They come in heat at all times of the year, but not frequently between the first of April and the last of August. The presence of the buck has its influence upon the appearance of heat. The doe is in heat in season about every three weeks, and the period lasts from one to three days. The signs are unmistakable, and the owner can use his judgment as to when to breed.

THE TIME TO BREED.

The information just given above shows that the owner of goats may, in a general way, choose his own time for breeding. When goats are kept for family use, where a supply of milk throughout the year is desirable, a practice is in vogue of so arranging the breeding that some of the does may drop their kids at one time and others about six months later. It is only by such a method that one can expect to have a constant supply of milk.

NUMBER OF KIDS AT ONE BIRTH.

The usual number of kids at one time from milch goats is two, but instances are not rare where there are three. Mrs. Edward Roby, of Chicago, has a doe which at one time had four kids and the next time three. A picture of this goat is shown in plate 1, figures 1 and 2. There is a record of a Nubian goat which dropped eleven kids within twelve months—four on each of two occasions and three at another.

Whether the doe shall be required to raise so many kids—or even one, for that matter—will depend upon circumstances. If the breed is exceptionally good and the kids therefore worth more than the milk, it is obvious that the kids should have first consideration.

RAISING THE KIDS.

If the sire and dam are of pure breeding, or have been selected from nondescript stock because of their milk characteristics, it might be profitable to raise the kids, but with ordinary animals the most economical plan is to kill the male kids as soon as born or as soon as they are old enough for use as meat. The object in view in keeping the female kids is milk production and flock increase; if their breeding promises nothing in the matter of milk production, which is likely if the sire happens to be of poor quality, they, too, should be slaughtered.

All things taken together, the advisability of raising the kids depends upon "dollars and dimes," and this is a matter that each breeder will be able to decide for himself better than anyone else can do for him.

In European countries goat's milk always brings a higher price than cow's milk, and because of this fact kids are often raised on cow's milk. This is not a difficult thing to do. An ordinary nursing bottle answers the purpose fully until the kid is old enough to drink. There might be some danger in this method of raising the kids if the milk should happen to come from a tuberculous cow, for it is possible for goats to contract tuberculosis, notwithstanding the statement so often made that they are absolutely immune from it; and there is no other method known, except inoculation, more likely to communicate the disease. If the cow furnishing the milk is sound, this method ought to prove very satisfactory.

If a nursing bottle is brought into use it should always be kept clean. Particles of sour milk, that otherwise will collect in the nipple, will clog the opening, and very often produces sickness in the kid.

So soon as the kids are old enough to eat they should be allowed some green feed. If leaves of trees or weeds are available the kids will snip them off, and thus secure a mixture of diet, which is quite essential; for goats of all ages soon tire of one kind of feed if it is given without change. A little later the kids will begin to eat grain. Oats are generally considered the best grain for the growing animals, although other grains, when fed with judgment, give satisfactory results.

The time for weaning will depend upon the value of the kids. Assuming that the kids are sucking, because they are worth more to the owner than the milk, they should not be weaned until they can do just as well or better on other feed. This time will be not less than three months from birth, and not over four months.

A kid is one of the most delicate animals known until it is two or three weeks old. It is frequently said by sheep men that "almost nothing" will kill a very young lamb; less than that will kill a kid. It must be kept dry, be kept warm, and be well nourished. A cold rain

upon a young kid is about as certain to produce death as a bullet through its body. Angora goat raisers find it very necessary to ascertain from the first whether the kids are getting nourishment in sufficient quantity, as the milk-producing qualities of that breed are uncertain; but with milch goats this condition should not arise. However, it is better to keep close watch for a few days in order to guard against any mishap. After the kid is two or three weeks old it begins rapidly to develop a hardy nature.

IN-AND-IN BREEDING.

By in-and-in breeding is meant the mating of individuals that are closely related to each other. This practice is one which the careless breeder is very likely to permit or possibly encourage, but he should know that, except in skillful scientific hands, it may result in goats of weak constitutions. If we are to have a hardy race of goats in this country we must avoid everything of whatever nature that has a tendency to weaken the constitution of the animals. One of the evils from which the Angora goat industry is now recovering was the in-and-in breeding that was extensively practiced until a very few years ago. Let the milch goat breeders profit by that mistake.

The purpose here is not to condemn in-and-in breeding altogether, for it has in some cases proved to be of great benefit; but its success depends so much upon a thorough knowledge of the principles involved—information which is not possessed by the great majority of breeders—that goat men are advised to avoid the practice. Some families of goats, as of other breeds of live stock, will endure in-and-in breeding better than other families. A family of strong milking goats, which will thrive under close breeding, would be especially valuable, because it could be multiplied pure without injury by the admixture of blood less efficient in milk production. Such blood would be useful as purebred milch stock, and the males would be likely to be prepotent sires to use in improving the remainder of the breed or in grading up from common stock.

HARDINESS OF GOATS.

The goat is a hardy animal; but it must not be understood by this statement that it is capable of withstanding all of the hardships for which it is so frequently given credit. In a playful way the press writers and cartoonists picture the goat as being always thrifty upon a diet of posters and tin-can labels, and show it in great happiness in a vacant lot that is entirely wanting in weeds and other vegetation. It is surprising but nevertheless true that some people believe such stories, if one may judge their beliefs by their actions. Thousands of Angoras have been starved to death in inclosures—so-called pastures—where there was practically no feed whatever. Apparently the animals

were expected to gnaw the bark from trees large enough for saw-logs and to gather leaves and twigs at a height of 10 feet and more.

The hardiness of the goat is ascribed to various causes, such as the large amount of exercise and fresh air that it gets in gathering its food, the great variety of food that it secures in thus wandering about, and its practical freedom from tuberculosis consequent upon the above conditions; but it can not maintain this hardiness without exercise, with little fresh air, or with little feed, and that of one kind only. There must be also a good shelter from storms easy of access at all times, and protection against extreme cold must be afforded in winter. Under the conditions first named in this paragraph the goat is likely to remain healthy; but it should not be assumed that it is not subject to disease. The same precautions should be exercised toward it that are accorded sheep.

After an experience with goats of various breeds, extending over a good number of years, I have been forced to the conclusion that these animals, under the conditions in which they are usually maintained in this country, are not the hardy creatures they are popularly supposed to be, and which I myself at one time thought them. No doubt in a wild or semidomesticated state on the rocks and mountains where they love to roam, and where they obtain the kind of food best suited to their requirements, these, like most other animals under similar circumstances, rarely suffer from disease. But housed in overheated and badly ventilated stables or pastured on rich, moist soil, this hardihood no longer exists, and goats become subject to some of the diseases common to sheep and cattle.—*Pegler*.

POINTS TO BE OBSERVED IN PURCHASING GOATS.

Aside from the technical points governing the selection of a buck or a doe, there are a few others that are worthy of consideration and they are discussed here.

If a registered goat is purchased, both the seller and the purchaser should be anxious to see that the transfer of the certificate is properly recorded with the registry association. This is usually done by the purchaser after the seller has turned over to him the certificate which he holds. The purchaser should insist upon this action. He should also obtain from the seller a copy of the pedigree of the animal. Of course, right now, when registration is just beginning, a pedigree will necessarily be very short, but the purchaser should have what there is of it. It is not necessary to discuss the value of pedigrees, but live stock men all know how important a pedigree is.

An animal is not necessarily a good one because it is registered; but its registration indicates that its sire and dam have been bred along right lines, and the chances are that it will be useful for the purpose for which it is bred.

There are some advantages in purchasing an old goat, say 5 or 6 years old. She will know better than a young one how to care for her kids; she will have become accustomed to the milking operation,

and probably she will give a larger quantity of milk than a younger animal. Besides, if a goat has once given milk, one has a pretty fair index of what she will do in the future. The purchaser should be on the alert in order that a goat may not be sold to him that is so old as to have passed all its days of usefulness. The teeth will show the age until the animal is 5 years old, but after that, in the absence of authentic records, dependence must be upon the judgment based upon general appearances. The condition of head and eyes indicates old age better than any other features. A goat is not to be considered old because it is thin in flesh, for this condition is a prevailing characteristic among milch goats. It is next to impossible to put any fat on one that is giving milk.

The purchaser should insist upon healthy animals. If he should get one that is sick he not only stands a chance of losing it, but the sickness may spread to all the others of the flock and finally result in total disaster. This would be especially true of the disease known as takosis, which is described in Bulletin No. 45 of the Bureau of Animal Industry. The animal selected should show spirit in eyes and ears, give evidences of plenty of blood, and be a hearty feeder. Condition as to fatness should not have much weight, but make sure that the thinness is not due to poor health. Ordinarily the bucks may be expected to carry more flesh than the does.

PRICES OF MILCH GOATS.

So far there has been very little dealing in milch goats in the United States, and therefore no really definite price. It is evident there will be as many different prices as there are different kinds of goats. The common American goats can be purchased at this time, if one is so fortunate as to find them, at \$2.50 to \$10, while no prices have been made upon any of the purebred animals. The basis of the price to be paid must depend upon the value of the animal to the purchaser, and in such a case the purchaser himself is the best judge.

The best milkers of Malta sell at \$18 to \$25, while the various breeds of Switzerland bring about \$20 each. In Syria and Egypt they may be had for a price as low as \$4 each. In England prices are very much higher. A very fine milker in the latter country will sometimes bring as much as \$40; if a pure Toggenburger, the price is more apt to be \$100 or more.

WHERE TO PURCHASE GOATS.

"Where can I purchase milch goats?" That is the question that has often been asked of the Bureau of Animal Industry, and it will probably be repeated a thousand times more. The difficulty is that a definite and entirely satisfactory reply can not be given; but it is proposed here to give the best information at hand for the benefit of pros-

pective purchasers. At this time, right at the beginning of a new industry here, it is, of course, not expected that there are anywhere large flocks to which correspondents may be referred; and if such flocks are brought together very soon they must necessarily be of the common stock. With only about a score of purebred does in the country at this time we can not hope for a sufficient number of kids very soon to supply the demand for animals of pure breeding. It is the purpose of the owners of these purebred animals, however, to keep the blood pure through the imported does and to use the pure bucks to the fullest extent practicable upon selected American does. This method should soon produce a considerable supply of grade kids of considerable value.

It is obvious that for a time those who desire to purchase milch goats will have to depend principally upon the common American stock, and these animals will be found generally in the suburbs of the larger cities, where sometimes as many as half a dozen may be found in a flock. In the Southern States a considerable number will be found here and there on farms, especially upon those farms tilled by colored people.

Occasionally there are Angoras that give a large quantity of milk, but they are not numerous. The milk of the Angora is equal in quality to that of any of the milch breeds, and some analyses indicate its superiority over all of them.

LENGTH OF A GOAT'S LIFE.

Goats have been known to live to be 16 years old, but such instances are rare. The average length of a goat's life is probably about 12 years; and, in the case of does, if they have been well cared for during all of their lives, they may produce kids until that age, but the ability to produce milk is greatly diminished. Under the ordinary conditions of goat raising, an animal is in her prime when from 5 to 7 years old. If one should possess an exceptionally good doe, one which transmits her good characteristics to her offspring, he would have a doe worth his while to keep till old for breeding alone.

The buck's period of usefulness depends more largely upon his care than that of the doe. If not managed with good judgment, his vitality is liable to be exhausted before he becomes very old. If he is kept vigorous by good feed and put to service rationally, he should be yet a good getter at 10 or 12 years of age.

HOW TO DETERMINE THE AGE.

It is not a difficult matter to determine the age of a goat until after it is 4 years old. The accompanying illustration (fig. 3) from Bryan Hook is very helpful to an understanding of this matter. During the first year of a kid's life its teeth are small and even and sometimes separated, as shown in the illustration; the second year shows the two

front teeth as being much larger and higher; the third year adds two more large teeth; the fourth year, two others; and the fifth year, two others yet, which completes the set. After this time the only way to know a goat's age is from records that may have been kept; but one may form some judgment of its age by its general appearance.

GOAT'S FLESH AS FOOD.

There is a prejudice in most countries against goat's flesh as food. This is the outgrowth of experience with common and milch goats, the flesh of which, from mature animals, is tough and often of strong flavor. In some parts of Asia, especially in Asia Minor and Syria, the goat, however poor its flesh may be, is the only economic source of fresh meat, and many are used there in this way.

The kids are everywhere considered a table delicacy. There is in the meat none of the unpleasant features of that from the older animals, and it is generally said to be superior in flavor to lamb. They should be slaughtered for eating when from one to three months old. A correspondent of this Bureau, in writing of the goats kept in the Italian settlement at Palisades Park, N. J., states that the kids, when dressed at eight weeks old, sell readily at \$3 to \$5 each. Of course, this locality is near the largest and best market of the country, but the delicacy of their flesh ought to insure a ready market anywhere.

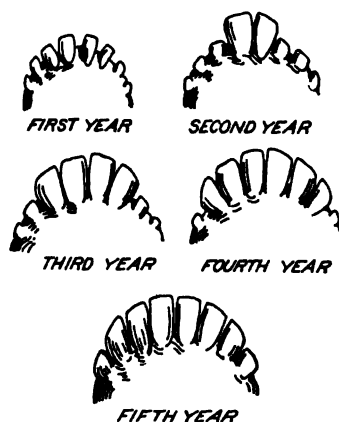


FIG. 3.—How teeth show the age of goats.
(Copied from Bryan Hook.)

THE SKINS.

The skins of milch goats are of better quality than those of the Angora breed, and are the kind used in the manufacture of shoes and gloves, and those from the colder parts of the country are better than those from the warmer parts. Inasmuch as the United States imports millions of dollars' worth of goatskins annually, it would seem that there should be a ready market for all that might be produced here. It is estimated that the skin from a kid of two months is worth when dry about 25 cents.

Probably most people who handle goats know how to care for the skins, but for the benefit of those who may desire information on this point the following is copied from Pegler:

The operation of flaying should be performed as soon after the death of the animal as possible, for if it be delayed any length of time the hide may deteriorate in quality; this is sure to be the case if the goat dies from disease and has been left until decompo-

sition has begun to take place. To remove a skin properly requires some skill and care, so as not to cut it with the knife, and at the same time leave as little flesh and fat attached to it as possible. Those who are inexperienced in such work had better employ their butcher's slaughterman, who for a trifle will kill, flay, and cut up their goat in a workmanlike manner. When the skin has been taken off, all the bits of flesh and fat adhering to it should be carefully removed with a knife, and the hide placed to dry, the hair side inward, in a covered, airy place free from damp. To prevent it from shrinking the head and tail ends should be stretched out and nailed on a board, and the leg parts spread out with skewers. Skins are sometimes preserved with salt and dried afterwards, but salt should not be used where it is intended to convert them subsequently into leather, as it never becomes thoroughly eradicated. The process of salting consists of laying the skins flat on the ground and well sprinkling the flesh side with salt and alum, more particularly on the edges and spinal portions. They are then folded by being doubled, first lengthwise down the center, and then one fold over the other until a square is formed; they will keep good in this manner for a considerable time, and may be dried afterwards.

MILCH GOATS AS BRUSHWOOD DESTROYERS.

The pronounced habit possessed by Angora and common goats of eating brushwood and weeds in preference to any other feed is well known, and the thought will doubtless occur to many people that milch goats have the same predilection; and, indeed, they have. Whether or not brushwood is the best feed for them is a question that should be considered. German writers on the subject of milch goats discourage the practice of some of allowing the goats to browse largely upon brushwood. They contend that the twigs and leaves not only have a tendency to impart an unpleasant flavor to the milk, just as in the case of cows, but lessen the milk supply and shorten the period of lactation. In foreign countries the goats wander along the roads and up the mountain sides and gather whatever feed may be accessible, but only a small percentage of their food is brushwood.

In this country the case will probably be that the feeding grounds will usually contain some brush and a small amount will hardly do harm; on the contrary, a little brushwood browse will serve as a tonic and thus help to ward off disease. The act of browsing furnishes exercise—something which is an absolute necessity. However, it would not be well to place goats giving milk in pastures where they can have their fill of leaves and twigs, even if the temptation to do so is strong. Milch cows are not profitable under such conditions, and there is no reason why goats should do any better than cows. There are always kids, however, and the brushwood pastures would prove a most excellent place for them; there they would thrive under the most favorable conditions.

The proper feeding of milch goats is discussed elsewhere in this article. (See p. 34.)

THE MATTER OF FERTILIZER.

It has been estimated by careful observers that the value of the manure produced by one sheep, in regions where manures are purchased at commercial prices, is \$3.30 per year. There is no special difference between the manure of the sheep and that of the goat, except that the latter animal produces more of it. But it will depend upon circumstances whether this average of \$3.30 per head is actually realized. If the goats remain upon rocky hillsides or in a stony pasture both day and night, very little good will result from the fertilizer; but if they are confined in a house at night or in a small inclosure where the manure can be collected and saved, or if they run upon land that is later to be used for the production of vegetables, grain, or grass, it will prove to be very valuable. The influence of a very few animals is felt over a considerable area of land. There is a permanency in the effect of such manure upon the land that can not be obtained from commercial fertilizers, yet many farmers waste barn-yard manure and pay high prices for the latter.

Angora goats have been given much well-deserved credit for destroying the brushwood and weeds upon valuable land and at the same time depositing upon the land a good coating of fertilizer. This clearing and fertilizing, aided by the sun's free access, have caused fields of blue grass to spring up where only weeds and bushes grew before. Milch goats will not do less if the opportunity is afforded them. But it must be borne in mind, as elsewhere mentioned, that much browsing is likely to have a bad effect on both the quantity and the quality of the milk.

HORNS OR NO HORNS.

Some German writers make strong claims, without specifications, however, for goats without horns, but a study of the matter seems to show that as between the horned and hornless varieties there is no difference in the amount of feed required or in the quality and quantity of the milk produced. The hornless varieties are not so likely to do injury to each other when running in flocks as those bearing horns, and in this respect are desirable. It is the opinion of this writer that the presence or absence of horns has no influence upon the value of the goat as a milk producer, but it is granted that the horns are a nuisance and of no value to the animal except as a weapon to be used against dogs. In forming new breeds or subbreeds it might be found, not only possible, but very desirable to breed hornless types.

WATTLES ON THE NECK.

The processes, or appendages, two in number, attached to the under side of the neck of many goats occasion no little comment regarding

their significance. Some have a notion that the presence of wattles indicates pure breeding or a large infusion of pure blood. This is not the case, however, as many of the most useless common goats have them, while some purebred milch goats do not have them. Wattles are not confined to goats. Many people are familiar with a peculiar kind of hog which was numerous in the Indian Territory twenty or more years ago that had wattles very much like those on the goat. So far as the writer knows these processes signify nothing and have no function.

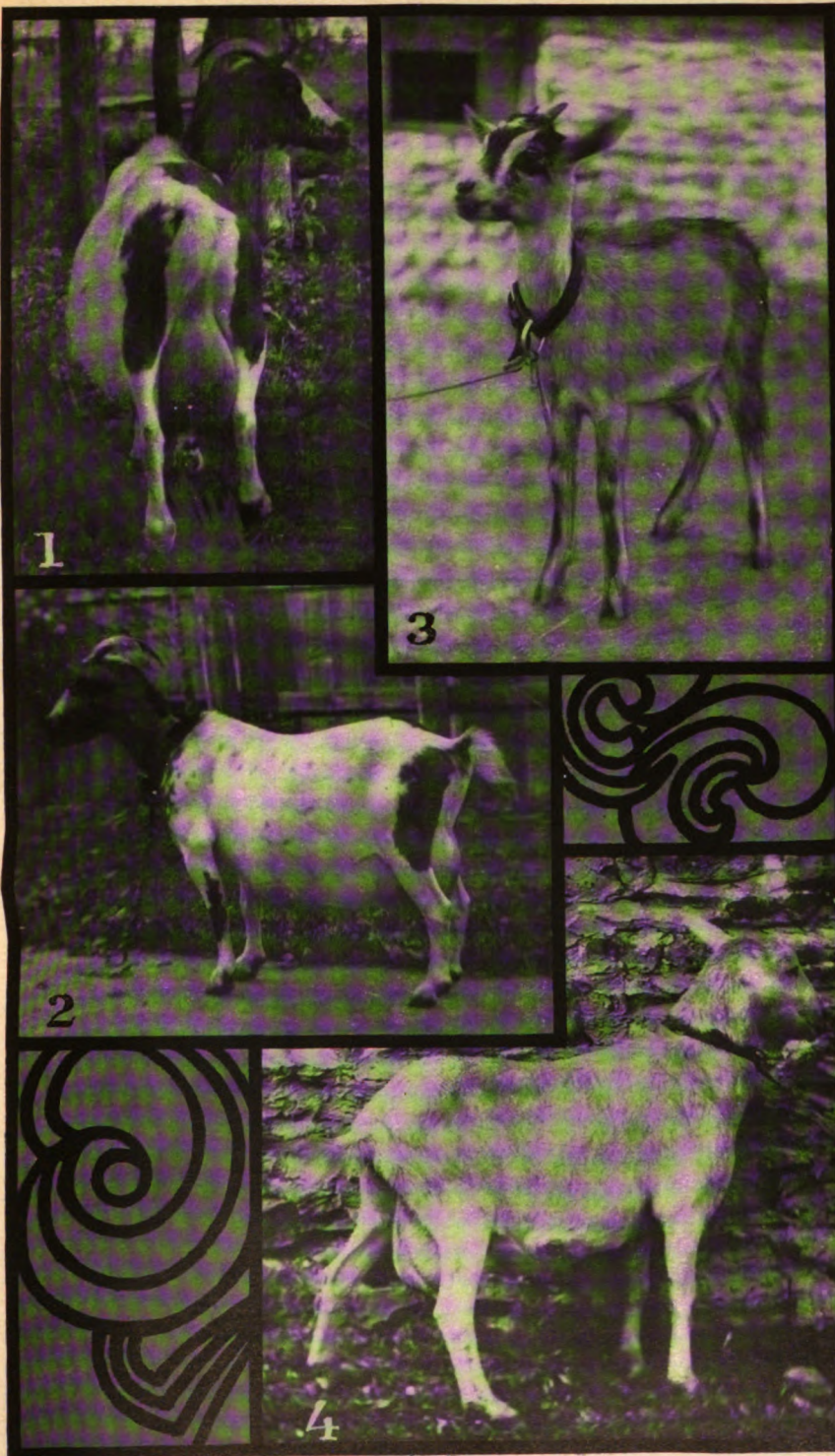
WORRYING BY DOGS.

Dogs do not worry goats to the extent that they do sheep; but the failing is not with the dogs. The goat is better able to take care of itself and is more inclined to do so. However, it will never be entirely safe to expose kids where there are worthless curs in the neighborhood, for this is the class of dogs that usually worries sheep. It is not often that a well-fed dog of good blood is guilty of worrying sheep. Kids are not able to care for themselves. Grown goats will offer fight, and a sheep-killing dog never wants to encounter any other animal that fights; and yet a hungry dog may do considerable damage to a goat that offers fight. Whoever is familiar with the common goats that are so often found about livery stables has observed that dogs always give the goat the right of way; these goats have been trained to fight, and this has made them masters. A goat does not need much training to make him fight a dog, and this little should be given to a buck for the benefit of the whole flock.

IMPORTATIONS AND IMPORTING.

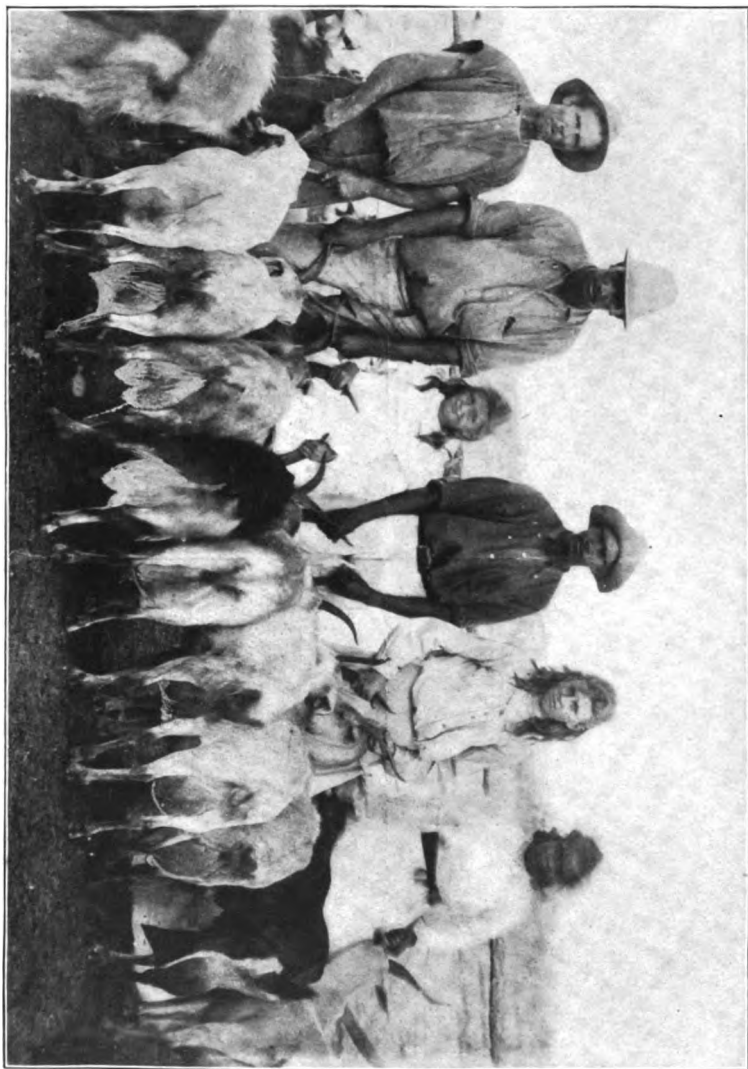
We shall never know how many goats have been landed upon our shores from foreign countries previous to the establishment of strict quarantine by the Department of Agriculture; but in the aggregate there must have been quite a number, since they came as mascots of sailing crews; and, too, immigrants were sometimes successful in landing with kids in baskets. However, there appears nowhere to have been an effort to keep the blood of any such animals pure, and any virtue that there might have been in any of the breeds imported was soon dissipated in the numerous and indiscriminate crosses that followed. It is not likely, however, that any such animals were of the leading milk breeds, such as those of Switzerland, Malta, or North Africa. They probably came, rather, from Italy, the West Indies, South America, or the British Isles.

The real record of importations of milch goats into the United States begins with the date of July 11, 1893, when W. A. Shafor, Hamilton, Ohio, who is secretary of the American Oxford Down Record Asso-



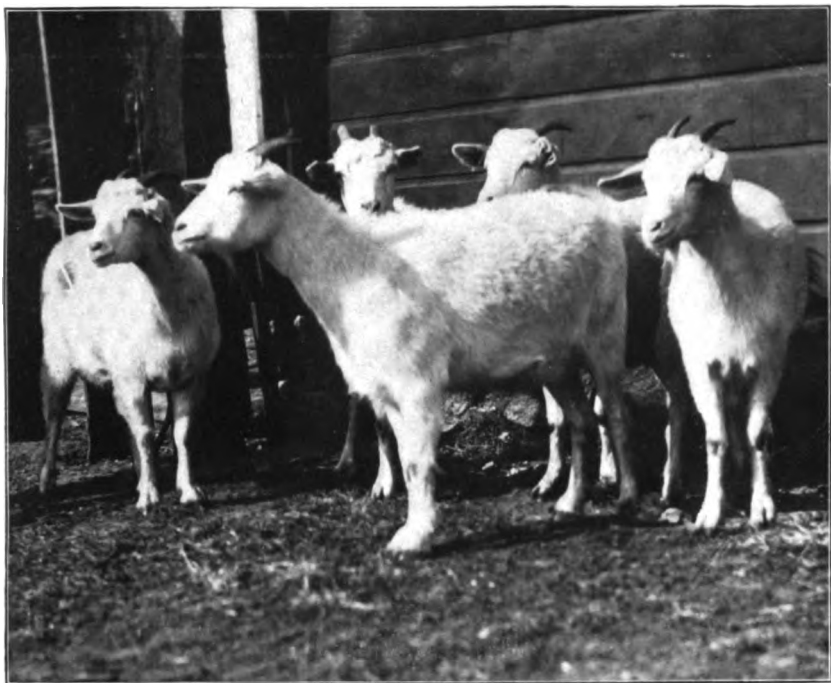
AMERICAN MILCH GOATS.

Photographs furnished by Mrs. Edward Roby and Dr Wm. More Decker.



QUEENSLAND MILCH GOATS.

Photographs furnished by J. R. Chisholm, Queensland.



AMERICAN MILCH GOATS.

Photograph furnished by Wyatt Carr, Iowa.



AUSTRALIAN GOATS.

Photograph furnished by H. Hocking, Australia.

ciation, and also secretary of the American Milch Goat Record Association, imported 4 Toggenburgers which he purchased in England. Owing to many adversities, not of sufficient importance to recount here, these animals did not thrive, and at this time only a few head remain.

The second importation was made by William J. Cohill, Hancock, Md.; Robert N. Riddle, Carteret, N. J.; William More Decker, Buffalo, N. Y.; and S. King Bayley, Westwood, Mass. These animals were personally selected in Switzerland by F. S. Peer, all coming through the Canadian quarantine. They arrived in the United States May 25, 1904. This importation consisted of 16 Toggenburgers and 10 Saanen. They had a hard voyage and consequently arrived in very poor condition. Five have since died, but the death of 3 of these resulted from accident. The remainder of the importation is now reported to be in excellent condition.

It is necessary to record here another importation (date unknown) of two milch goats from the Black Forest of Germany (usually regarded as Swiss goats), now the property of William J. Cohill, of Hancock, Md. These animals he secured from Carl Hagenback, at the World's Fair, in October, 1904. The breed to which they belong is not definitely determined, but, as elsewhere stated, the writer is of the opinion that they are of the Schwarzwald breed. As both of the goats mentioned are does, and there are no others of the kind in the country, so far as known, the breed can not be perpetuated pure under present conditions. A picture of one of Cohill's goats of this breed is shown on plate 7, figure 3.

REGISTRATION.

The American Milch Goat Record Association was organized on November 12, 1903. It came into existence for the sole purpose of encouraging the establishment of a milch goat industry in the United States. Recognizing the difficulties to be encountered in importing purebred animals from Europe and Asia, the founders of this association decided to admit animals upon a very liberal basis. It was evident that the foundation stock of this new industry, with very few exceptions, must be selected animals from the nondescript varieties already in the United States. Therefore it was decided that the chief qualification for registration in this association should be that the doe shall yield at least 2 quarts of milk per day. The period of lactation to be required has not yet been determined upon.

This association registers all breeds which have the proper qualifications, and under this registration the animals are known as American milch goats, a proposed breed which is discussed on the next page following.

As there are now in the United States a few head of purebred Toggenburg and Saanen goats, every effort should be made to keep them pure; and, although they are registered as American goats, a separate register for each of these breeds has been started and all the importers have registered their stock in them.

Further information regarding registration may be obtained from W. A. Shafor, secretary of the American Milch Goat Record Association, Hamilton, Ohio.

BREEDS OF MILCH GOATS.

The goat was probably one of the first animals to be made to subserve the interests of man, yet no other domestic animal has been bred so aimlessly and so carelessly as it has been. It is found in all parts of the world, and the varieties are so numerous that no effort has been made at any time to classify them into breeds. The purpose in this work is to mention but a few, and these of the milk-giving type. It must not be understood that this list mentions all of the kinds of milch goats, but those only which have been developed most highly for milk production. Only a few of the Swiss breeds are described, although Anderegg is authority for the statement that there are in Switzerland not less than sixteen pure breeds of goats. It appears that each valley there has its own distinct type of goat and the resident of no valley has any desire to import a variety from another valley, no matter how beneficial this might prove to be, and, indeed, his own valley people would resent such action.

The descriptions which follow are almost wholly from German writers on goats. The breeds that are represented in the United States are the Toggenburg, the Saanen, and the Schwarzwald. The other breeds are mentioned in order to give such information as is at hand for the benefit of those who may desire to know something about them.

The American goat.—This is a name which has been suggested for the breed which it is desirable to develop by selection from the so-called common goats now in this country. It is known that among these goats there are often found some excellent milkers, although their origin is obscure. We are told that some of the Italian immigrants have frequently brought with them from the old country very young kids in baskets. These were cared for as one of the children and among the children, and they have no doubt grown up and exerted a considerable influence upon the general average of the milk supply in the neighborhoods to which they were taken. Other good milkers are said to have been brought from Bermuda, and this blood has probably had its effect also. We should not be surprised, then, when we occasionally hear of a goat that will give from 1 to 2 quarts of milk

daily. Very recently this Bureau has been informed by a business man of New Jersey that there is a large number of goats kept in the Italian quarter at Palisades Park, and upon special inquiry he learns that the average amount of milk produced, so far as an estimate can show, is 3 pints per day. This milk retails among the Italians at 12 cents per quart; and butter is also made there from goat's milk to a limited extent which sells at retail in New York City at 30 cents per pound.

These are the kind of goats that should be selected as a foundation for the American breed, and if their milk characteristics were further increased by crossing with either the purebred Toggenburg or Saanen bucks which are now in this country, we should soon see a breed that would produce a satisfactory amount of milk and at the same time have all of the hardiness possessed by our common goats.

Some work along the lines suggested has already been done in various places, and occasionally a very good milker is produced. One of these animals showing excellence is Watita (pl. 1, figs. 1 and 2). When this doe was fresh and on green food, she "gave almost a gallon of milk per day," to quote her owner's words. The illustration, which is furnished by Mrs. Edward Roby, the owner, of Chicago, Ill., shows the doe at $3\frac{1}{4}$ years old and 3 months after her second kidding. At the first kidding of the doe she dropped four kids and three the second time. Her conformation and record show her to be a very desirable animal as one of the mothers of the American milch goat.

Two similar animals are Bluebell and Mrs. Cotton (pl. 1, figs. 3 and 4), photographs of which are furnished by Dr. William More Decker, the owner, of Buffalo, N. Y. A glance at the picture of the former shows her to be much above the ordinary goat, while the latter shows some of the markings of the Toggenburg breed. Bluebell is 5 months old, bluish gray trimmed with black, and the hair noticeably soft. Her mother produced a good quantity of milk that was of very high quality.

The writer is indebted to J. R. Chisholm, of Queensland, Australia, for the photographs of the row of milch goats shown by plate 2. This gentleman states that there are in his country large numbers of such goats that will yield 3 quarts per day. They are not purebred animals, and, so far as is known, they have no blood of any of the pure breeds. The animals shown in the illustration indicate what is possible for American breeders.

The Maltese goat.—This well-known breed of goats is, as the name signifies, from the island of Malta, in the Mediterranean Sea. The island comprises but 95 square miles, and its population at this time is about 200,000. There are kept on the island, however, about 30,000 goats (among which are enumerated a few sheep) for milking

purposes, while the number of cows is only about 900. There are no pastures there. David G. Fairchild, agricultural explorer for this Department, notes that the goats are fed on scraps of all kinds, such as they may be permitted to pick up on the streets, where they usually wander about in small droves. This habit of subsistence is certain to give to the milk an unpleasant flavor, and it is not a matter of surprise that the English contingent of the population prefer condensed milk from England or the United States. "Their milk has the usual strong taste," says Fairchild, "but is drunk either alone or with the morning coffee by many Europeans regularly, and one soon becomes accustomed to it."

The proper winter food for the Maltese goats is the chick pea, broad bean, and sulla, all of which are grown all over the rocky island. In summer they obtain much feed from the leaves of maize and prickly pear.

The hair of this breed is long, the color being white and reddish brown or black. Hook says, referring to those which have been imported into England, that "the color is almost invariably white, with more or less red markings."

The Maltese goat is usually hornless, but the presence of horns is not an uncommon sight. The legs are short and the body compactly built. The ears are moderately long and are horizontal. The udders are large, oftentimes nearly touching the ground as the animal walks.

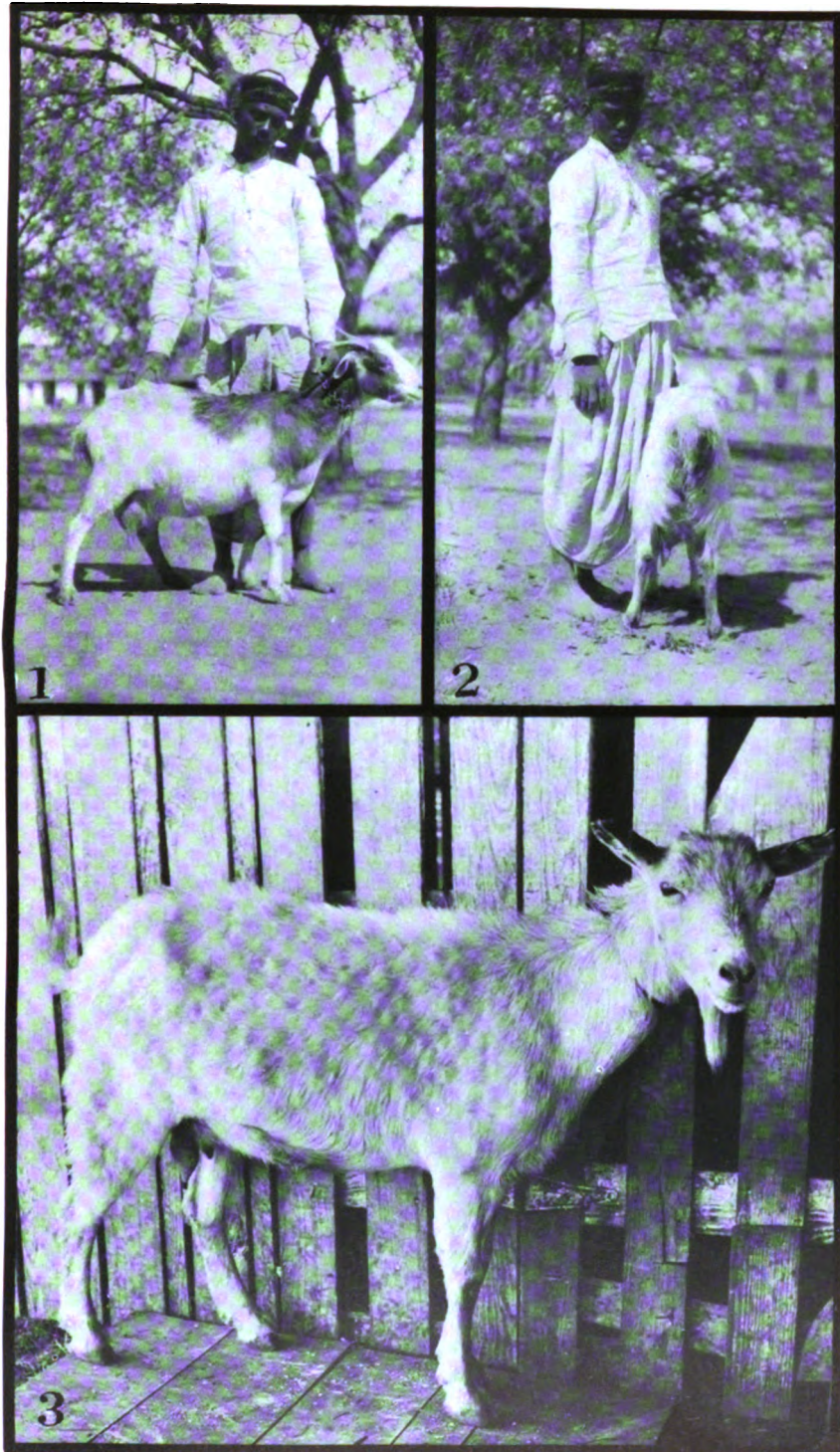
Hook says that it is quite difficult to acclimatize them in England. The weather appears to be too cold and wet. The real injury is probably due to the wet cold rather than to the cold alone, for they have hair enough to protect them against ordinary cold. We know that no dry cold is too severe for the Angora, but a little wet cold often causes death, and probably the Maltese is influenced in the same manner.

The same difficulty of acclimatizing would no doubt be encountered in some parts of the United States, but Fairchild, who is familiar with the climate of Malta, says:

It is my opinion that, with proper attention to the matter of feeding and a consideration for their social habits, this breed of goats might be introduced into southern California with great advantage. They could possibly be substituted for the wild breed which now overruns the rocky islands off the coast near Santa Barbara.

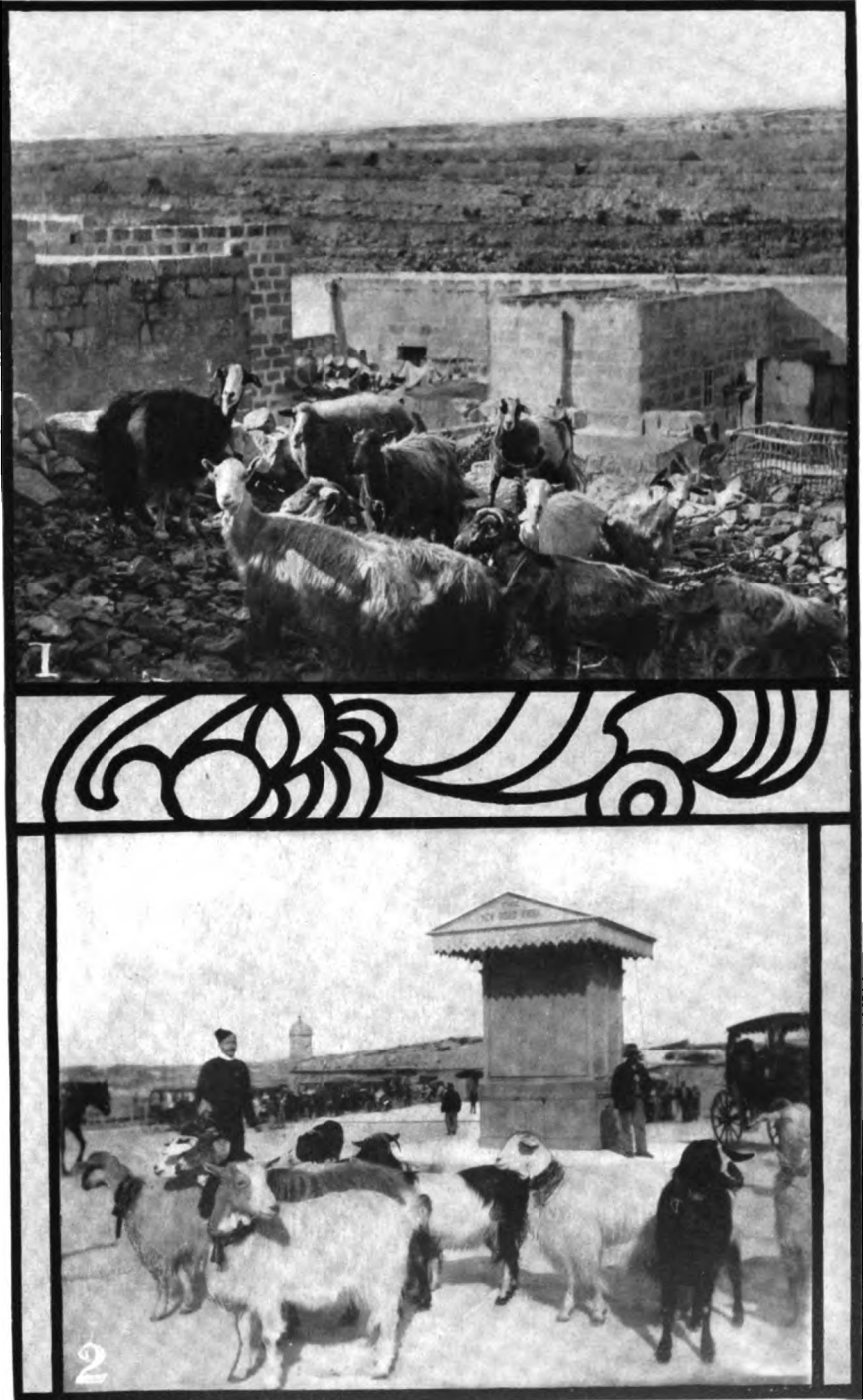
There is a prevalent idea on the island of Malta that the Maltese goat does not do well when transplanted to the mainland, but the idea is a mistaken one. This breed of goats when raised in Tunis, for instance (pl. 6, fig. 2), is in every way equal to those raised in Malta. Fairchild's observation was that the goats thrived as well and the udders were as fully developed in Tunis as in Malta.

Whether or not the Maltese goat will thrive in any part of the United States is a matter for the future to settle, for no animals of this breed

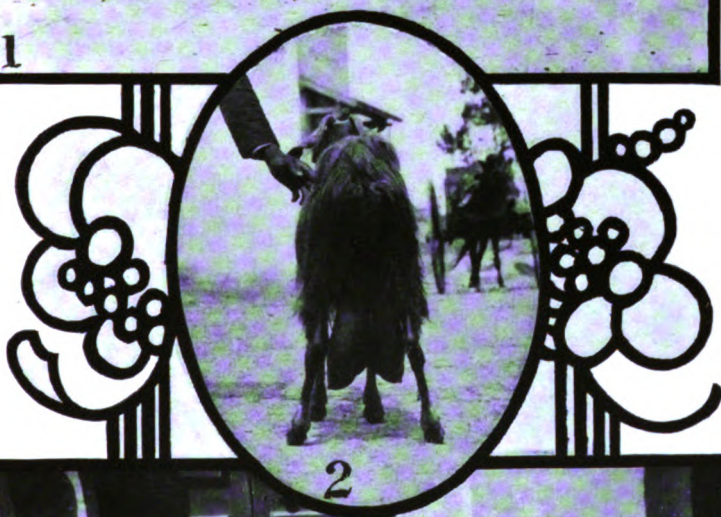


FIGS. 1, 2.—POONA (INDIA) GOATS. FIG. 3.—SPANISH-MALTESE GOAT.

Photograph of first two furnished by David G. Fairchild and of the last one by B. H. Van Raub, Texas.



MALTESE MILCH GOATS.
Photographs by Sallie Russell Reeves.



MALTESE MILCH GOATS.

Photographs by Sallie Russell Reeves and David G. Fairchild.

have ever been imported. If a warm climate is necessary, our entire South and Southwest would undoubtedly prove adaptable. All long-haired goats now in this country thrive well in the cold sections, if they are not exposed to wet cold, and it is confidently believed that the Maltese, having long hair, could soon be acclimatized. The long-haired Mexican goat finds no difficulty in surviving the cold of our Northern States, and the Maltese may prove itself as hardy. A few years ago a few head of Maltese goats were imported into Canada, and it is reported that they are there fulfilling all expectations.

It should be stated in this connection that this breed is entirely different from the Spanish Maltese goat, which is discussed hereafter.

With reference to milk production, the Maltese goat is among the best breeds. They have been bred so long in Malta for the single purpose of milk production that most of the does are good milkers. This feature is more constant among them as a breed than among the Toggenburg or Saanen breeds. The period of lactation is a long one, and the quantity of milk given is from 3 to 4 quarts daily.

The milk vendors in this island drive their animals along the street from door to door, and draw the milk as it may be required by the purchaser. The man or boy having the goats in charge squats behind the animal and draws the milk into a cup.

The Toggenburg goat.^a—This breed is called the aristocrat of the milch goat family. There are some breeds that are more hardy perhaps, some that are more prolific, some that will show occasional individuals of greater milk production, and several that present a more robust appearance, but the Toggenburg seems to combine in itself more of these characteristics in high degree than any other breed.

This breed is from the Toggenburg Valley, a district forming a considerable portion of the Canton St. Gallen, in the northeast section of Switzerland and about 70 to 100 miles from Berne. Here they have been bred for centuries.

The color of the animal is brown (not dark brown), with a white bar down each side of the face, which may easily be seen in the accompanying illustrations (pls. 7, 8, and 9). The legs, below the knees and hocks, are light gray or almost white. There seems to be a general understanding throughout the Toggenburg Valley as to the markings and general characteristics of these goats, except as to the length of the hair. There are long-haired and short-haired Toggenburgers, and some breeders select the one kind as being more hardy and some the other kind, disputing the greater hardiness of the long-haired ones. Peer says: "Where I found in one flock Toggenburgers having long,

^aThis description includes that of Mr. F. S. Peer, who visited the Toggenburg Valley early in the year 1904.

medium, and short coats, I was not able to get a positive answer that one was hardier than the other." All agree, however, that the coat, whether long or short, should be thick and fine.

Notwithstanding the lanky and lean appearance of these animals, the does are quite attractive. The bucks have a harsh and most serious expression, owing principally to the shape of the head and the large, coarse beard. They are not given to fighting, however, and are free to a large extent from the odor that is generally so objectionable in males among most other breeds of goats.

The udder of the Toggenburger when distended is carried high between the legs. The teats are usually very large and long.

The Toggenburg is generally called a hornless breed, but instances are not uncommon where horns are developed. Peer states that he did not see a specimen having horns in the Toggenburg Valley, owing no doubt to the custom prevailing there of weeding out those that develop horns. And he further says that "among the animals of this breed selected by me for importation to the United States, one gave birth to a female kid that developed a perfect set of horns, which by the time she was 3 months old were fully 5 inches long." It is remarkable that at this writing (December, 1904) only one other kid from this importation has been born, and it, too, like the one Peer mentions, has horns.

The breed is somewhat slender, and one of its principal characteristics is its great leanness. Except for its greater size, it much resembles the Appenzeller; indeed, Hook, referring to the peculiar coloring and deer-like shape of the Toggenburger, says the facts suggest the possibility of its being a cross between the Appenzeller and the chamois, which abounds in that section of Switzerland. Peer says the opinion is general among the Swiss peasantry that the Toggenburger is the result of such crossing; and, while he believes this is extremely doubtful, he mentions a kid having "as perfect a pair of horns as ever was seen on a chamois." It may well be doubted if any cross of the kind was ever produced. The ears are pricked usually, but sometimes held in a horizontal position, and are of moderate size, as is the case with all Swiss varieties.

In discussing this breed, Hook points out an important feature which is applicable to all breeds, namely, that the high position occupied by the Toggenburgers as milk producers has been attained by the careful selection of individuals for breeding, and from their offspring, preserving those only for breeding which have proved themselves to be good milkers. This practice can not fail to lead to definite results if the selections are made intelligently. The Toggenburgers are especially noted for their great milking qualities, and in this particular they probably excel all other breeds, unless the Nubian is excepted. In Switzerland there are a goodly number of the more intelligent breeders

of these goats who are breeding only the best milkers. These goats give from 4 to 5 quarts a day, as a rule, while the best produce from 5 to 6 quarts, and, in extraordinary cases, as much as 7 quarts per day. Their persistence in giving milk is a noteworthy characteristic. Some of those that were imported last May (1904), and which were in lactation for the first time, are still giving milk (December, 1904), and will probably continue to do so until they are "dried off" by their owners. And yet they were carried from place to place in Europe before being placed on shipboard at Antwerp, then a sea voyage covering much more than the usual time before reaching Canada, and finally three days by express (without being milked or fed apparently) to their destination.

This breed can probably be acclimatized in the United States without difficulty. They will fare better in the mountainous sections than in the lowlands, and whenever they are taken to the lowlands they should be kept strictly away from marshy places, else their hardiness will soon disappear. Hook's observations on the Toggenburger in England are contained in the following:

The Toggenburg goat is, in my opinion, by far the most valuable and the best suited to our climate of all the pure breeds that have been introduced into this country, and, having now become fairly common and well established with us, is the breed I should unhesitatingly commend to the attention of goat keepers.

The Saanen goat.^a—The Saanen breed (pl. 10) takes its name from the Saanen Valley of Switzerland, which is about 70 miles southeast of Berne, where they are quite numerous; but they also abound in the Upper Simmen Valley. The Saanen is the largest breed of Switzerland; it is quite tall and lean and lanky, like the Toggenburgers. Its color is pure white or creamy white. The hair is short, except a strip along the spinal column and down the flanks and on the lower part of the thighs.

The Saanen does are especially beautiful, with slim, long, graceful necks, and clean, breedy looking heads; the head of the buck is decidedly masculine, but does not have the serious expression of the Toggenburger. The breast is well developed; as a rule, the udder is very pretty and carried high. This is considered a hornless breed, but, as with the Toggenburgers, occasionally one is found with horns.

Germany imports many of this breed, especially of the males, in order to cross them upon the German farm goat, and the resulting improvement has been very pronounced. In 1893 it is said that several thousand head were taken out of the Saanen Valley. Notwithstanding this fact, the German writers are very careful to warn prospective importers that the breeders of Saanen goats in Switzerland are never inclined to sell their best milkers and that there are likely to be

^aThis description includes that of Mr. F. S. Peer, who visited the Saanen Valley early in the year 1904.

a large number of very poor milkers, which they do sell to anyone who will buy. In other words, while the name of this breed means much for some individual animals, it also means that the name is not a guaranty of high merit. Peer says:

As compared with the Toggenburg family, my observations lead me to say that, as a family, there are probably more large milkers among the Toggenburgers than among the Saanen, but that the best of the Saanen goats are superior to the best Toggenburgers. In other words, taking a given number of each breed as they come, I would expect the Toggenburgers to show the largest total yield, but among the best of each breed, I would expect the Saanen to win.

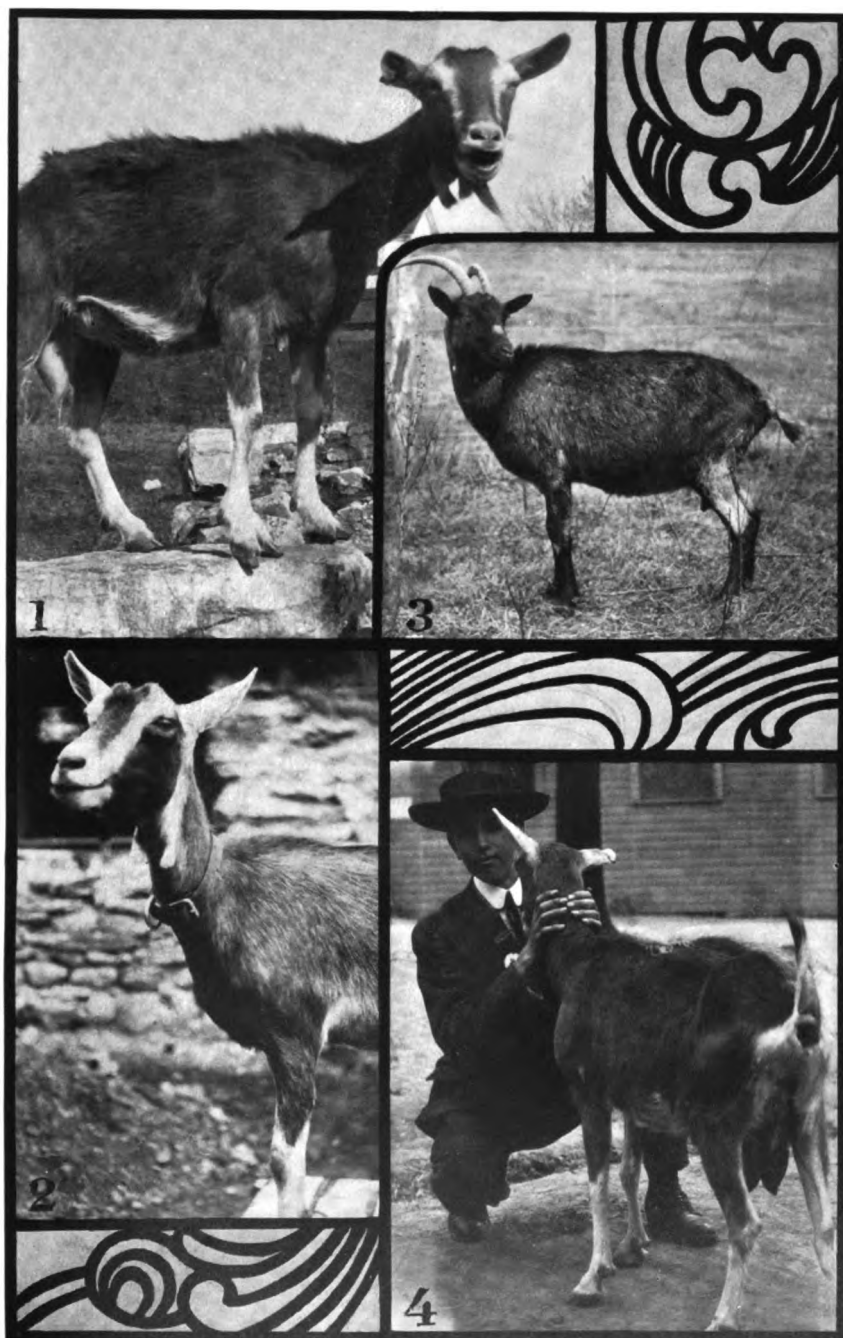
Doctor Kohlschmidt, director of the agricultural school at Freiberg, Saxony, conducted experiments in 1896 and 1897 with various goats to test their capacity for milk production, and one of his conclusions was that the Saanen goats, which had been imported into Saxony in 1894, with the same feed and methods of keeping that the Saxony goats had, could not be classed as anything better than the Saxony goats, as regards both quality and quantity of milk. Dettweiler speaks of Saxony as a place "where no one bothers himself about the goat," and therefore we have the right to infer that the Saanen goats which entered into Kohlschmidt's test had not been selected for importation with that care which is pointed out by most German writers to be so necessary. However, if the Saxony importations of 1894 were selected without much care, they proved to be fair milkers, as we shall see by the records below, and the Saxony goats that equaled their yield were excellent for common stock. In Kohlschmidt's experiment ten Saanen goats were employed—seven of them 3 to 3½ years old, and three from 2 to 2½ years old. The average quantity of milk produced during the year by these ten goats was 678.41 liters, and the smallest production was 421.94 liters. The following statement shows the annual production per head:

2 gave over	400 liters (423 quarts).
3 gave over	500 liters (528 quarts).
1 gave over	600 liters (634 quarts).
2 gave over	800 liters (845 quarts).
2 gave over	900 liters (951 quarts).

Animals of this breed which were fourteen months old gave an average during their first lactation of 509.72 liters per head per year. The maximum was 665.69 liters and the minimum 351.31 liters.

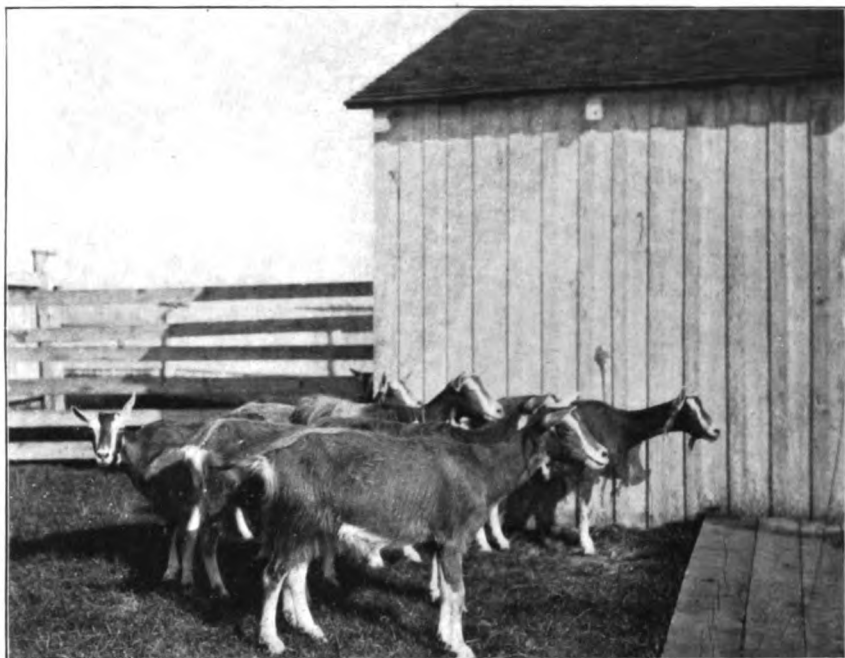
Wilsdorf says that Saanen goats, for a time after kidding, give from 4 to 6 liters of milk per day, and that "this yield happens not occasionally, but, as a rule, in the Saanenthal;" and Peer says "the best of them are probably the best in the world, giving from 5 to 6 quarts per day of the very best quality."

Neither Pegler nor Hook mentions any specimens of the Saanen breed in Great Britain, and it is not likely that there are any there.



FIGS. 1, 2, 4.—IMPORTED TOGGENBURG GOATS. FIG. 3.—SCHWARZWALD GOAT.

Photographs furnished by Wm. J. Cohill.



TOGGENBURG GOATS IN SWITZERLAND.

Photographs by F. S. Peer.



IMPORTED TOGGENBURG GOATS.

Photographs furnished by S. King Bayley, Massachusetts.



SAANEN GOATS IN SWITZERLAND.

Photographs by F. S. Peer.

Several head came to the United States in the Peer importation in May, 1904, and so far they seem to be acclimatizing very well. With rational treatment they will probably do well in any part of the country, but especially in the mountainous sections.

The Appenzell goat.—This is another Swiss breed. It shares with the Toggenburger the right of possession of the Toggenburg Valley, where both breeds are raised side by side. As the Government grants a subsidy to these breeds when kept pure, but never does so when crossed, they are seldom allowed to interbreed. The Appenzeller is a good milker, and is considered inferior only to the Toggenburger and Saanen. It is often mistaken for the latter, especially in the case of those that are pure white. Some of them are, rarely, dark or spotted.

The Appenzeller weighs about 110 pounds. Its head is flat and hornless. One of the strong claims made for it is its great hardiness. It is easily acclimatized. In Switzerland many are kept in stables.

Anderegg is authority for the statement that the Appenzeller produces $3\frac{1}{2}$ liters of milk per day.

It is said that the results of crossing this breed with either the Toggenburg or Saanen breeds are always negative.

The Schwarzthal goat.^a—This breed, sometimes called the Glacier goat, or the saddle goat, belongs to Canton Valais, of Switzerland, and is specially numerous in the Rhone Valley. The frontispiece of Hook's "Milch Goats and Their Management" is a picture of several of these goats in the Rhone Valley. It is a large animal, having legs and horns resembling the chamois and a tuft of long hair on the forehead. It is a very striking animal because of its size and its coloring. The first third of its body, including the head, the neck, and the breast, is black, while the remainder of the body is pure white; these colors meet just back of the shoulders. The front hoofs are black and the hind ones white or yellow.

This is one of the hardiest of the breeds, if not the hardiest, as it withstands exposure better than any other of the goats of Switzerland or France. Because of this hardiness principally, but somewhat on account of its peculiarly striking colors, it is selected for export to Holland, Germany, Norway, and Sweden.

Another peculiarity of this goat, according to Pegler, is that "it almost invariably has but one kid at a birth," though it yields a large quantity of milk.

The quantity of milk given by this breed is not equal to that yielded by the other principal breeds of Switzerland, and the quality is also inferior. The following is from Hook:

Very large herds are to be seen on the Eggishorn and Reider Alps. At the latter place I once chanced upon a herd just as the herdsmen commenced the evening

^a This description includes the observations of Mr. Peer.

milking. There were two milkers, and as each goat was finished a young assistant caught and presented another, and the whole herd of fifty or sixty animals was milked in a remarkably short time, the produce being carried in one of the upright tubs upon the herdman's back; but I must say that I considered the amount on this occasion very small for so large a number of animals. These goats, however, were not so carefully treated, and not housed as are those of the Toggenburg Valley, and after having been milked were driven off to spend the night upon the mountain side.

At the time of Hook's writing (1896) the only specimens of this breed in England were in the possession of one man. There is very little in print about them, but that little seems to indicate that their hardiness is their only feature that would recommend them for the United States.



FIG. 4.—Schwarzwald Goat. (Copied from Hoffmann.)

The Schwarzwald goat.—This breed (fig. 4) is generally fawn colored, with a black stripe down the middle of the back, some dappled, and occasionally some white animals. The skin is soft and smooth, with short shining hair. The head is graceful. About one-fourth of the goats are horned. The eyes are gray, the ears thin, long, and placed well up. The neck is thin and slender and well set, with abundant hair about the throat. The withers are low, the chest quite broad, the shoulders rather strong and rounded, the back even, and running on an even line to the hips. The belly is very thin, and does not hang down. The hips are long and somewhat sloping. The hind legs are often somewhat bandy; the position of the forelegs is normal. The udder is, in the greater number of cases, large, pliant, and thinly covered with hair, and is placed well back between the hind legs; the teats are somewhat large.

The animals are bred in the region of Neckar and Donau, southwestern Germany. The occupation of goat breeding is divided among the laborers, factory hands, poor people, and also the middle class; the people possess, on an average, two animals apiece, the highest number being seven. Stables, with pasture, are rented out from September till November. The city of Tuttelingen, for two years past, has conceded a permanent pasture to the goat owners.

On plate 7 (fig. 3) is shown a picture of one of two goats which William J. Cohill obtained from Carl Hagenback, at St. Louis, and this writer is of the opinion that these goats are of the Schwarzwald breed. The description, which is from a German author, and a comparison of the illustrations, with the further aid of a personal inspection of the specimens in Mr. Cohill's possession, lead easily to this conclusion.

The Langensalzaer goat.—The district in Germany where this goat is bred is the Northern Thuringia, the upper section of Unstrut, between Heinrich and Hainleite, including the district of Langensalza, the western part of the district of Weissensee, the southern part of Muhlhausen, and the northern part of the Duchy Gotha. The altitude of this section is from 450 to 1,000 feet. Löbe says this breed is especially suitable for level tracts of land.

This breed (pl. 11, figs. 1 and 2) is of various colors—brown, black, and white, or a mixture of these. In the Langensalzaer district the prevailing color is white. This goat is hornless, according to Dettweiler. There appears to be no uniform type, but three classes may be distinguished: (1) The common goat, almost identical with the common goat of Thuringia, and having no purity of blood; (2) a goat improved by breeding and selection, found in the neighborhood of Langensalza; (3) a goat improved by crossing with Saanen bucks.

The third class is preferred, and it predominates; and it is the one usually in mind when the Langensalzaer goat is referred to. In its improvement it has much of the appearance of the Saanen breed.

Petersen's description of the Langensalzaer goat is in the main as follows: It differs from the Saanen goat in its more refined frame, shorter limbs, and long barrel. The coat of hair is generally short and smooth, rarely long; the forehead almost square; eyes large and intelligent; ears erect and pointing forward; neck long and slender but somewhat heavier at base than elsewhere; withers well rounded; back straight; hips dropping; chest narrow, but deep and extending far back; belly round, but not hanging, and showing deep "hunger hollows;" loin not very deep; hind legs inclined to be cow-hocked (occasionally there are cases of stiff legs). The bones are fine, and the pastern short. The udder is broad and deep, similar to that of the cow, almost globular, and not in two lobes, as in other Swiss breeds; teats

long and hanging forward of the legs, nearly reaching to the ground in old goats. Oftentimes two rudimentary teats are present and yield milk.

This goat is a good milker. The annual milk yield is often large—in individual cases having been known to reach 1,800 liters. (Dettweiler.)

The Starkenburg goat.—This breed is referred to in the German literature as a noble animal. It is the result of a large infusion of Saanen blood, and is oftentimes mistakenly called the Saanen. It is raised in Pfungstaad, Heppenheim, and vicinity.

The Guggisberger goat.—This breed, sometimes called the Schwarzenburg-Guggisberger (pl. 12, fig. 2), was originally from the Simmen Valley of Switzerland. It is brown, spotted like the chamois, commonly has horns, and is considered very excellent for milk. Of recent years it has been extensively crossed with the Saanen goats. Hilpert describes it as being built like the Saanen goat, of fawn color, or brownish white, and of astonishing size. He says it is excelled by no other breed of goats in milk production when under good care and feed. The Guggisberger is well proportioned, and the accompanying illustration shows that this breed has the points of a good milker. It is also said to be a near relative of the Oberhaslian goat.

The Gassenay goat.—The Gassenay goat is of Canton Berne, Switzerland. It is pure white, like the Saanen and Appenzeller. Anderegg, a Swiss authority on the goats of that country, speaks in very high terms of this breed. Hook says that a few specimens have been imported into England, but unfortunately have not been kept pure. Gassenay appears to be another name for the city of Saanen, and it is not unlikely that the goats bearing these names are the same breed.

The Harz Mountain goat.—This breed is the product of the Harz Valley and others connecting with it, all of which are from 1,000 to 2,000 feet above sea level. Here the soil is calcareous and the water comes pure from springs. The climate is rather rigid. The animal is astonishingly large and has a strong bodily development.

The color varies from whitish gray to reddish, with a dark streak along the back; sometimes it is black or brown, or a mixture of these colors. The hide is quite thick, a condition due to the severe climate. The hair is of medium length, seldom short and smooth; the head short and broad; eyes gray; ears long and narrow, yet many have lop ears or so-called mouse ears; horns absent in most cases; neck medium long, withers strong, back straight, loins and chest broad, belly deep, thighs rather full; the legs are generally straight, but in exceptional cases cow-hocked.

The udder is well developed, bilobed as a rule, with large teats hanging between or a little back of the hind legs. When fresh the milk production is from 2 to 4 liters a day, increasing in good animals to 5 liters, and the amount for the entire period of lactation, which is about three hundred and twenty days, is from 500 to 700 liters. The taste of the milk from this breed is especially good, and everywhere throughout the Harz Mountains the milk is used as an article of diet, especially for the poor and for the invalids who sojourn in that district in large numbers.

The Wiesenthal goat.—The Wiesenthaler is a hornless mountain goat with a middling long head and sparkling eyes. The hair is short and light in color. The udder is globular in form, with a good devel-



FIG. 5.—German Farm (or House) Goat. (Copied from Zürn.)

opment of teats. When the doe is fresh her yield of milk is from 2 to 5½ liters per day, the average being about 3 liters. The quantity for the whole period of lactation varies from 600 to 900 liters. Petersen (from whom these notes are made) mentions one case where 982 liters were produced from a doe that had a lactation period of three hundred and fifty days. The quality of the milk is excellent, having especially a high percentage of fat.

The Saxony goat.—This goat can hardly be regarded as a distinct breed. It has been developed by selection from the common, or farm, goats, and by the introduction of Swiss blood, principally of the Saanen breed. Doctor Kohlschmidt, an agricultural teacher at Freiburg, has

said that the Saxony goat is equal in milk productiveness to the Saanen. His opinion was based upon personal experiment; but it is said by others that the Saanen goats employed in this experiment were imported and in all probability they were very poor specimens, for nearly all German writers refer to the practice of the Swiss in selling their poorest animals, if possible, rather than their good ones and lament the fact that the German importations are of the poor kind.

However, experiments with Saxony goats which were conducted in 1895-96 in the locality of Lauenstein, Altenburg, and Geising, with 30 goats, gave the following results, which indicate that the Saxony goat is an excellent milk producer. The annual milk yield of 27 goats of various ages, based on five experiments, was found to average 725.7 liters per head. Of the 24 mature goats, 9 gave 600 to 700 liters per head, 7 gave from 700 to 800 liters, 4 gave from 800 to 900 liters, 1 gave over 900 liters, and 3 gave 1,000 liters. The highest milk yield was 1,077.5 liters and the smallest 612.3 liters per annum. The average lactation period was three hundred and thirty-two days, and the percentage of butter fat in the milk for the entire period of lactation showed a minimum of 2.74 and a maximum of 4.41, with an average of 3.43. These results show that the Saxony goat is a good milker and altogether a very desirable animal.

The Westphalian goat.—Frequent references are made in foreign literature to this breed, but Dettweiler is the only writer who gives any real information about it, and he gives but little. The quantity of milk which it gives varies. At Warstein the production is said to be but 2 liters per day for "fresh" goats, with a total annual yield (or for the whole period of lactation) of 200 liters. Other schedules are in existence, however, which show the annual yield to be from 365 to 500 liters. Dettweiler quotes the following from Mr. Petrasch, a magistrate of Hallenburg:

Average quantity of milk for fresh milkers, 3 liters daily.

Maximum quantity of milk for fresh milkers, 5 liters daily.

Minimum quantity of milk for fresh milkers, 2 liters daily.

For the entire period, 500 liters.

Duration of lactation, 330 days.

The Hinterwald goat.—The district of the Hinterwälder (or Forest goat) embraces the whole upper plateau of the Black Forest. The description of this breed is after Huber, a veterinarian of St. Blasieu. The color is white and brown, giving a gray mixture; the skin is thin, soft, elastic, and covered with short to medium-length hair; there is an absence of horns according to Huber, but Dettweiler, from whom the illustration (pl. 12, fig. 1) is copied, shows an animal with horns; fairly long face and broad forehead; jaw well developed; mouth large and broad; eyes large and clear; ears erect; neck strong with a cir-

cumference equal to its length; chest well developed, being broad, deep, and long; back generally straight; loins generally well developed; hips, dropping; legs sometimes cow-hocked. The udder in full-grown animals is well developed, firm, elastic, both halves being of uniform size, and hangs low in old animals only.

The milk yield is about 3 liters per day; it amounts to 4 liters in exceptional cases. The annual yield varies from 600 to 650 liters, testing 3.75 per cent fat.

The Hungarian goat.—There is very little information at hand regarding the Hungarian goats. Neither Pegler nor Hook mentions them, yet the following description of a single specimen was published in the proceedings of the Royal Agricultural Society, England (vol. 15, p. 664, 1879), in the words of the judges of the show at Kilburn:

The prize winner, of Hungarian breed, exhibited by Lady Burdett Coutts, was certainly the largest he-goat that has ever appeared at any show. He was devoid of horns and had a fine head, with broad chest, level back, and well-sprung ribs, without being too long in the leg. He measured 34 inches in height at the shoulder and 46 in girth.

The Alpine goat.—Descriptive writers who have visited Switzerland have seldom failed to mention incidentally "the Alpine goat," yet very little is in print about it as an animal of economic value. Peer made no little effort to learn something about this goat, and the description here given is practically in his words.

The Alpine goat may be termed the native goat of Switzerland, corresponding in name to our "common" goats and the German "farm" goats, but not corresponding in important characteristics. These goats are found throughout the whole Alpine chain. There is but little uniformity among them, and therefore they can hardly be classed as a distinctive breed. They resemble grade animals of nearly every description. In one section certain markings may prevail and in another they are quite different. They have horns generally and are a hardy, serviceable animal.

The want of attention to certain uniform characteristics disqualifies them for breeding purposes among those who wish to follow a certain standard or type of breeding. In some districts in the Swiss Alps and also the French Alps some attempt has been made to breed to a certain form and color, but as a rule they are better classified as "all sorts." In France and Switzerland there are a few distinct families like the Saanen and Toggenburg; all the rest, except foreign goats of a distinct breed, seem to be lumped off as "Alpine goats." In some parts, however, local names are given to these goats. Some of these animals are exceedingly beautiful.

The Tarentaise goats from the French Alps, which are usually seen at the French agricultural exhibition at Paris in the beginning of

March, are very striking. They will be found described below under the heading "The Tarentaise goat."

There is another Alpine goat that is believed to have some local name. It is of a solid mulberry or mahogany red. These goats have a very short, shiny coat of hair, which sets off their graceful forms to perfection. They have very beautiful, clean heads, and altogether are, as described by Peer, the most breedy looking goats he has ever seen.

If these animals could be relied upon to breed true they would certainly be most valuable animals in the hands of any breeder who admires quality and beauty. There were quite a number of these so-called Swiss and French Alpine goats on exhibition at Paris last year, together with several other Swiss and foreign breeds, such as the Toggenburgers, Saanen, Nubians, Maltese, etc., which were said to be mostly from the zoological gardens of Paris. They created as much if not more interest than any of the other animals of the great exhibition.

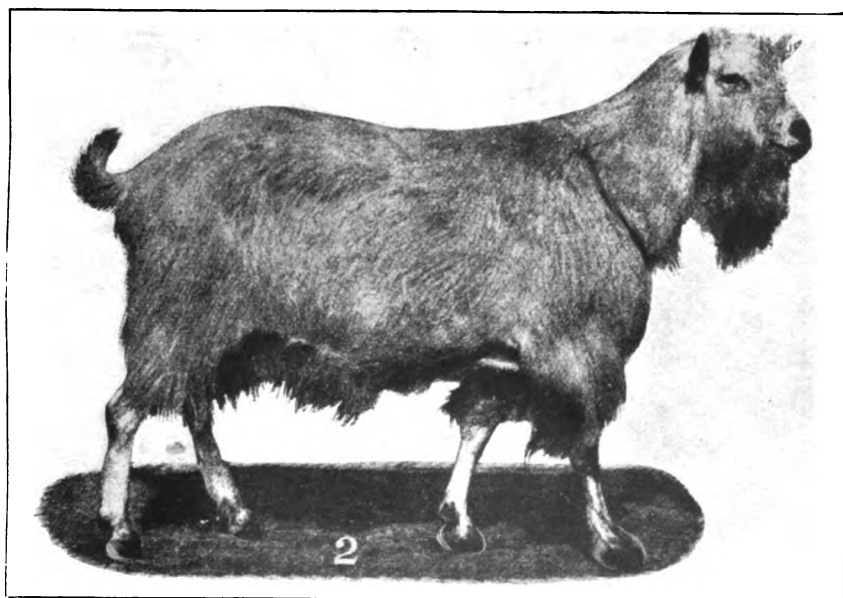
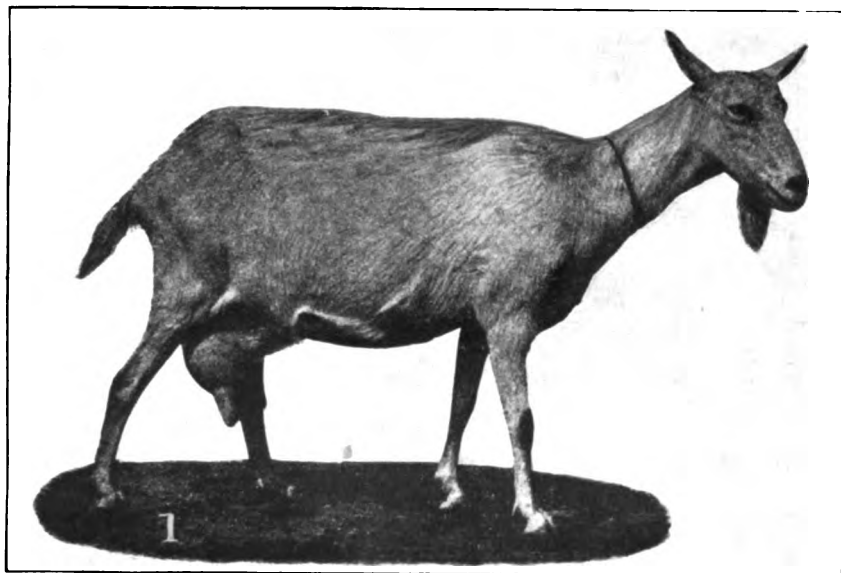
All of the Alpine goats, whether of the Swiss or French Alps, are good and useful animals. They are of early maturity, hardy, and give a good quantity of milk. Peer says they give from 4 to 5 quarts a day and that the best ones are said to give as much as 6 quarts a day.

There are over half a million goats in little Switzerland, a territory less than one-third the size of the State of New York. There are among this great number only about 3,000 or 4,000 pure Toggenburgers and 2,000 to 3,000 Saanen; probably 10,000 would cover all the distinct breeds; the balance (490,000) are natives, grades, and what are generally called Alpine goats.

The Tarentaise goat.—The Tarentaise goat is not considered a distinct breed, but is one of the several varieties of Alpine goats; and under the head "The Alpine goat," Peer describes it as a very striking animal. Its head and neck are saffron red and the body shiny black, with a black bar down each side of the face. It has sufficient merit to warrant its exhibition at the agricultural show at Paris, and is said to be a good milker.

The home of this variety is the Department of Savoie, in the French Alps.

The Pyrenean goat.—This goat, as its name signifies, is native of the Pyrenees Mountains. It has long hair, long, pendulous ears, and large horns. It is the tallest of all domestic breeds, except possibly the Nubian. Several heads have been introduced at different times into England and the crosses obtained from them have proved to be good animals. Pegler mentions some that were at the dairy show of 1884 "far exceeding in proportions anything yet produced in the way of goat breeding." This goat is a very good milker. Reports are



LANGENSALZAER GOATS.
Photographs copied from Dettweiler.

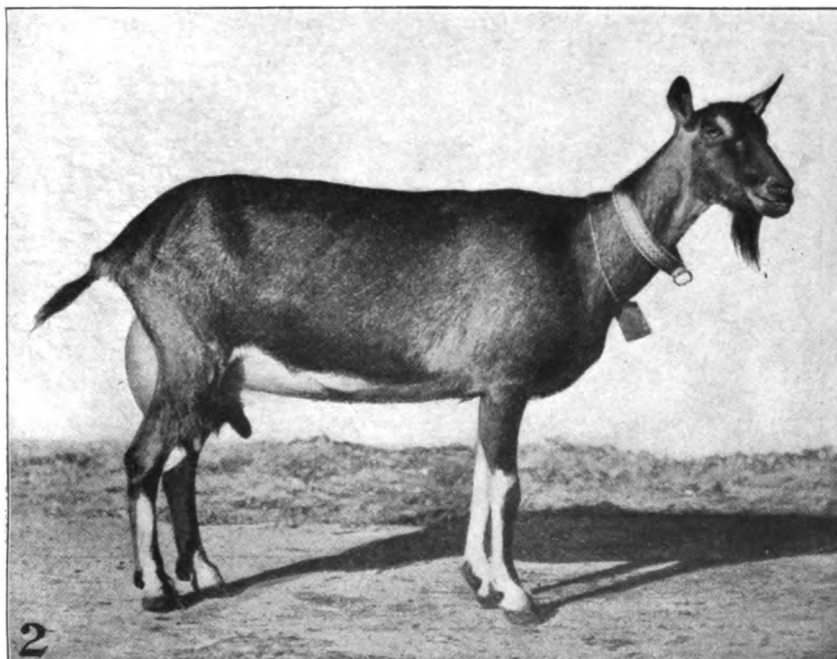
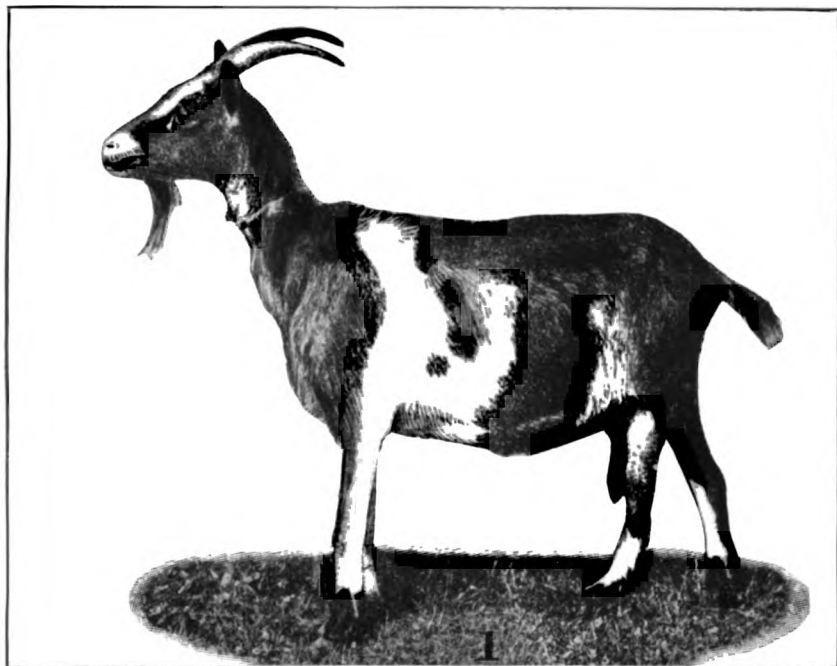
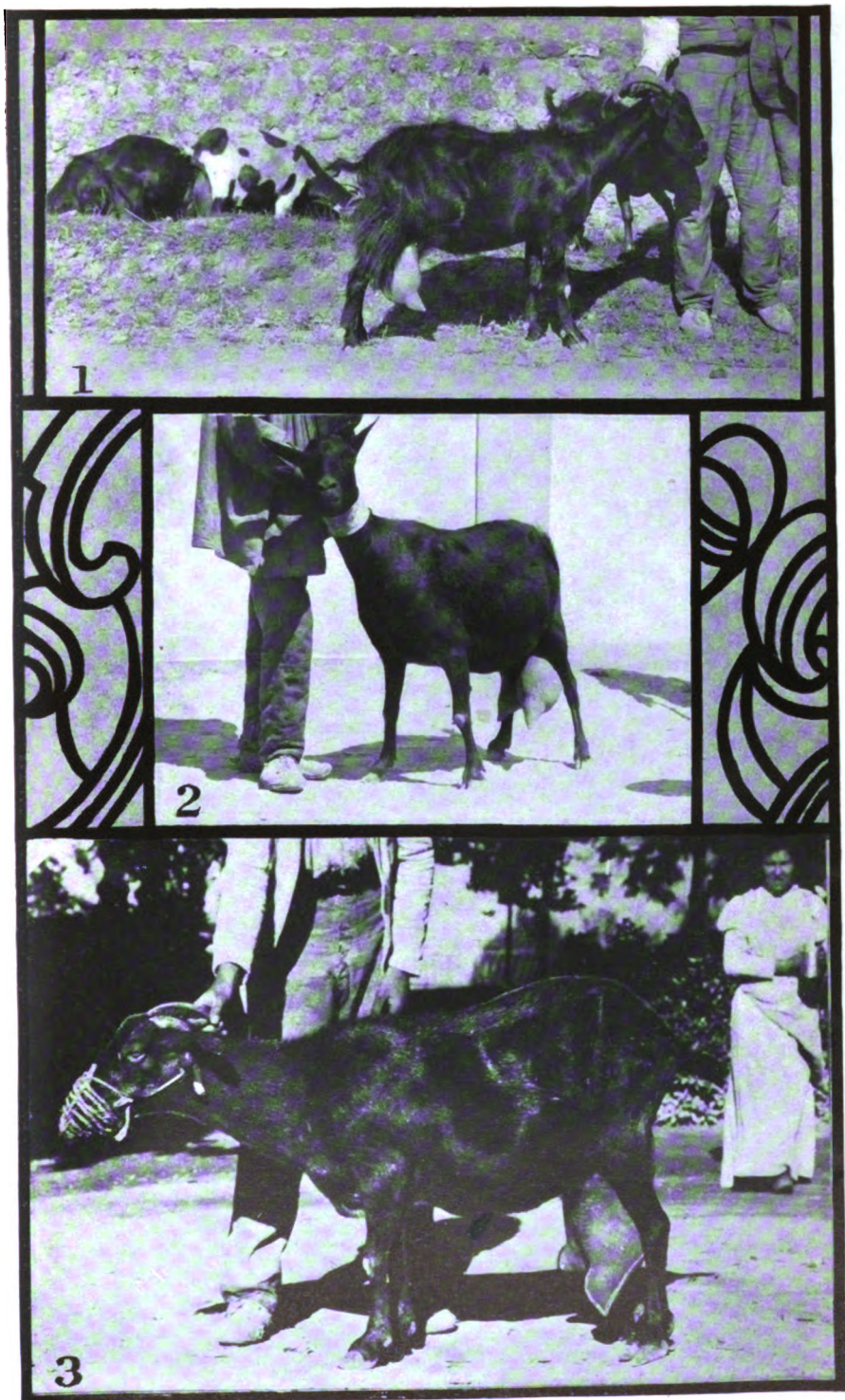


FIG. 1.—HINTERWÄLDER DOE. FIG. 2.—SCHWARZENBURG-GUGGISBERGER DOE.

Illustrations copied from Dettweiler and Hilpert.



SPANISH MILCH GOATS.
Photographs by David G. Fairchild.

published of large herds of this breed in the Pyrenees Mountains, where they are kept for the twofold purpose of cheese making and the production of skins for fine gloves. So far as known there are none of them in the United States, but they would probably thrive well in any of our mountainous sections.

The Spanish goats.—The term Spanish goat does not here mean a particular breed, for there are several varieties in Spain. Löbe refers to a "hornless Spanish goat," which is especially distinguished by its long silky hair. The illustrations which are shown on plate 13 are evidently quite a different variety from the one described by Löbe. These pictures are of the goats of Malaga and Granada, and were taken by David G. Fairchild, agricultural explorer of this Department. No records are available of the quantity of milk that the goats of Spain will give, but the size of the udder of those shown here indicates that it is considerable. It is said that all varieties of the Spanish goats are good milkers.

The English goat.—The English breeders began many years ago to produce from their nondescript stock a distinctive English goat. The lines of breeding which they pursued were the same as those proposed for the production of the American milch goat. The English have succeeded to a large degree, presaging the fact that the United States, with its more favorable climatic and soil conditions, ought to do much better in a shorter period of time.

England's climate is not suited to any of the imported breeds of goats, and her native goats were far from being satisfactory as milk producers. In order that there might be a goat that would withstand the damp climate and lowlands and at the same time produce a satisfactory quantity of milk, the English proceeded to import bucks of the Swiss and Nubian breeds for crossing upon the native does. By this method they have retained the hardiness of the native goat to a remarkable degree and at the same time acquired much of the milk-producing qualities of the Swiss and Nubians.

The following description of the English goat is from Pegler:

I have been at some pains to ascertain the points of the original breed; and from the descriptions in old works in which goats are mentioned, and a comparison with the features most prevalent at the present time, I believe the following description to be correct: Head neat and tapering, with moderate beard; frontal bone prominent, horns set far apart, rising slightly at first with an inclination to the rear, and then branching outward; ears rather large, but not actually erect nor yet pendulous, but more approaching a horizontal position, pointing forward. Body long and square shaped, with the coat short, but not so close as in the Nubian and some Indian varieties. In the male it is much longer, particularly at the neck, chest, and thighs, where it is very thick and stiff. A fine, soft, woolly undergrowth is nearly always observable between the hair. The color ranges from black to white, but is more often light or dark fawn, with a darker line along the back and black on the legs.

In a personal letter to this writer, Hook believes it would be wise for the people of the United States to secure some English goats to breed up the common stock here. It can hardly be doubted that the result of such a procedure would be very beneficial, for the English goat is really a good animal.

The Irish goat.—This goat is mentioned and described in order to forestall any desire to import the blood for American use. The following is from Pegler:

The hair is long and shaggy, generally a reddish black and white, or yellowish gray and white. The head, instead of being short and tapering, is long and ugly, the muzzle being coarse and heavy, with a considerable amount of beard even in the females. The horns are large and pointed, situated close to each other, and rising almost perpendicularly while inclining to the rear. Those of the male are very large, and attain sometimes an immense length, a pair in my possession measuring each 30 inches. Besides the increase in size, they open out more than those of the female. The size and shape of the horns render both male and female formidable antagonists when pugnaciously inclined, which they not unfrequently are, both to each other and to persons who are strangers to them, so that they are not altogether safe with children. The Irish goat is a rather taller animal than the English, but its gaunt, flat-sided appearance renders it anything but prepossessing. It is nevertheless a good milker, though the yield is comparatively poor in quality. The udder is generally long and narrow, with big teats.

Pegler does not say much for the Irish goat, but Hook, in the following, says less:

Of small size, with long shaggy coat and large horns, it has little but its low price to recommend it. Rare examples may be found to yield a large quantity of milk, but only for a few months after kidding; and, as it is impossible to induce these animals to breed, except as their half-wild nature prompts, the production of milk in winter is entirely out of their power.

The Welsh goat.—It is believed that in a former time there was a distinctive breed of goats in Wales and also in Ireland, but the Irish blood appears to have dominated and overrun both countries. It is believed that originally the Welsh goat was large, white in most cases, and of a kindly disposition; but this is not the case at this time. Pegler says of it:

In many points it resembles the Irish goat, but is smaller and more symmetrically shaped, the head and horns being more graceful and the body lighter. This breed is not of much value for milk. The udder and teats are usually small, and it does not remain any length of time in profit.

The Nubian, or Abyssinian, goat.—This breed (fig. 6) is the most peculiar of all goats, and in many respects differs so much from other goats that at a distance it may be mistaken for some other animal—at least not be taken for a goat.

It is a native of Nubia, Upper Egypt, and Abyssinia. With slight modifications, it may be found in other parts of the African continent as far south as the Cape of Good Hope.

Its size is extraordinary, being fully a half larger than ordinary goats, and it has very long legs. In a pronounced degree this goat

has the rounded forehead and nose that are so characteristic of all African sheep, but why this similarity exists no one ventures to say. Below the top of its head the forehead rises so as to form a conical prominence, then sinks toward the nose until the nostrils are in an actual depression. The lower jaw protrudes beyond the upper, and the teeth often extend above the nostrils. The ears may be flat, long, large, and pendant, or very short, straight, and pointed.

The Nubian is considered a hornless breed, and it is probably as nearly hornless as any breed, yet it frequently occurs that the bucks develop horns, which are flat and short, and which lie upon the back of the head. The horns at a distance midway of the length curve outward. There is an entire absence of beard, and the "goat odor" so common in the males of other breeds is entirely wanting in this one, not even appearing at rutting time. The eyes are large and lie flat in the head. The color is glossy black or dark brown. Several authors

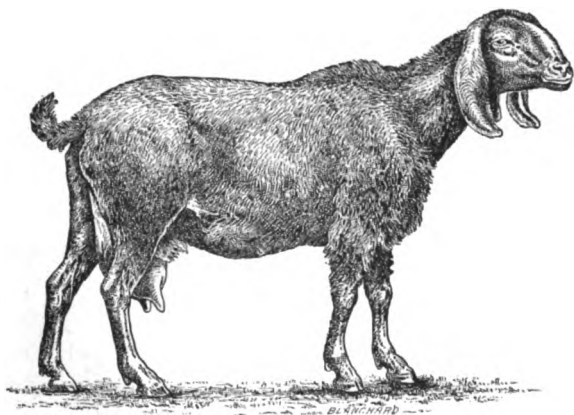


FIG. 6.—Nubian Goat. (Copied from Hoffmann.)

who are familiar with this breed assert that the hair is always short, while one, who is no doubt equally as well informed as the others, says the hair is long. The fact is that there are both kinds. Pegler describes it thus: "The hair is comparatively short in the male, but very much so in the female," yet he gives an illustration of a Nubian with long hair. It can hardly be doubted that the Nubian is closely related to some of the other breeds of northern Africa, all of which have long-haired strains among them. The skin is oftentimes much wrinkled.

The udder is deeply indented, or divided, so as to form very distinct lobes. The teats are situated, as in all species, on the lower part of the udder, but upon the outside.

The Nubian is the most peaceful and gentle of the goat family. It is not vagrant, and does not require delicate nourishment. The only objection that can be ascribed to it is such extreme sensitiveness to

cold that it can with difficulty withstand the slightest degree. For this reason, in France and England, it is always provided with a warm house during winter, and never turned out in the morning when there is frost. It is said that the slightest cold produces abortion almost instantly.

Crosses have been made of Nubian bucks upon selected common does with results very satisfactory. The crosses have better developed forms than the common goats; they are more robust, and partake largely of the physical characteristics of their dams. It is a pleasure to quote here from a letter by Wm. G. de Coligny, of Springfield, Mass., who had experience with Nubian goats in Ecuador:

Mr. Francisco Chiriboga, now deceased, a large cattle raiser in the province of Imbabura, northern Ecuador, had a flock of about twenty Angoras and one of Nubian goats, ten in number, which he imported from France, from the Government station at Souliac, department of Cantal. He used to cross them for the wool, milk, and meat. The Angora became fairly good milch goats, but not so good as the crosses from the Nubian upon the common goat. * * * The hair of the Angora-Nubian goats was not white, but very silky, fine, steeple pointed, and about 8 inches long; in some individuals 10 inches long.

The amount of milk produced from three or four Nubian goats and their crosses at that time (1877) was about 4 liters per head per day. Milk from the Angora-Nubians was about 2½ liters per head per day, and from the Nubian and common goat cross, about 3½ liters.

Of all domestic animals, except the rabbit and the hog, in the language of Du Plessis, the Nubian goat is the one which increases most rapidly. A French writer (Sacc) says that he has known one of these animals to drop eleven kids in one year, four on two occasions and three at another. This, of course, is an unusual case, yet it can be safely affirmed that Nubian goats generally have kids twice a year, and frequently there are triplets.

Sacc avers that the daily yield of milk per animal is from 10 to 12 quarts, and that it seldom falls below 4 quarts; and that the milk is universally pronounced excellent and of a higher fatty content than milk from native goats. Du Plessis thinks Sacc has exaggerated by regarding the exception rather than the rule. It is nevertheless true that the Nubian goat is the highest type of milch goats. Du Plessis regards a good yield for the Nubian is from 5 to 6 quarts per day. He conducted some milking experiments for five days with two goats—one a pure Nubian and the other a crossbred Nubian and native goat. The results obtained are given on the following page.

Production of milk by a Nubian and Nubian cross.

Day.	Nubian.		Nubian cross.	
	Quantity of milk.	Quantity of cream. ^a	Quantity of milk.	Quantity of cream. ^b
	Quarts.	Quarts.	Quarts.	Quarts.
First	4. 6358	0. 4012	4. 7699	0. 2228
Second	4. 6569	. 4063	3. 6115	. 2217
Third	4. 7836	. 4085	3. 5376	. 2212
Fourth	4. 9315	. 4191	3. 8966	. 2428
Fifth	5. 2166	. 4255	3. 8966	. 2534
Total	24. 2444	2. 0586	19. 6383	1. 1614
Average per day	4. 8448	. 4117	3. 9276	. 2322

^a Butter, 8.41 per cent.

^b Butter, 5.91 per cent.

Given a suitable climate, proper feed, and intelligent handling, this breed will excel all others in milk production. So far as the United States is concerned, however, its area of usefulness in its pure state will be limited, it seems, to the extreme Southern States and southern California. This is the opinion of De Coligny, who is familiar with this breed. However, among goats imported into Canada within the past two years there is said to be a Nubian buck that is withstanding the cold climate of that locality. The tenderest care must be his lot if he is a pure specimen. The writer has been unable to obtain any information about this animal by correspondence, or indeed, about other breeds of the same importation. A few Nubians may be found in England, where their value has come to be recognized for crossing upon the common goats of that country.

The Egyptian, or Nile, goat.—The description given of the Egyptian goat (*Capra ægyptica*) is after Hoffmann. This goat has a small head and either short horns or none at all. It has a facial expression that is remarkable and peculiar. The nose is short and stumpy, the nasal bone bulging upward. The lower jaw is longer than the upper one. The beard is often wanting. The eyes are small; ears about as long as the head, are narrow and rounded at the end, and are pendulous. The color of the hair varies from reddish brown to light yellow, and always lighter in color on the belly than elsewhere. The goat odor is never present. (Note the similarity of this goat with the Nubian, the Syrian, the Mamber, and the Zaráibi.)

The Egyptian goats are numerous in the Nile Valley as far as Nubia and Upper Egypt. They are regarded as among the best milch goats, and are said to give daily from 5 to 6 quarts of milk. Hoffmann says it has been claimed for this breed that a specimen has been known to give from 10 to 12 quarts of milk daily.

The African, or Widah, goat.—Löbe says the African goat in its conformation and peculiarities resembles the Angora, but is smaller. The short description given here of this goat is translated from the German of Hoffmann:

This goat is the most handsome and graceful of all goat breeds. It is of medium size and has a shapely head; has a robust, well-rounded, fleshy body, and better developed legs than any other breed of goats. The horns are thin and curve gently backward and outward, the point bending back again so as to form the beginning of a spiral. The hair is short and coarse; on the neck, back, sides, and legs it is black, but underneath it is yellow. The color may be reddish or yellow.

There is a subbreed of the African goat called the Dwarf goat (fig. 7). It is only 13 inches high and 26 inches long, according to Löbe, who makes no comment as to its value.



FIG. 7.—African Dwarf Goat. (Copied from Hoffmann.)

The Zaráibi goat.—The illustration (pl. 14, fig. 3) shows a prize-winning Zaráibi buck at one of the shows of the Khedivial Agricultural Society of Egypt. Nearly all travelers through Egypt who observe the live stock there mention this goat as a most excellent milker, and it always appears at the shows, yet no description of it is at hand. It is a large animal with long hair and especially characterized by its very long ears. The description of the Egyptian goat applies to the Zaráibi pretty well, but the writer has been told by visitors to Egypt that the former, although a good animal, is not the equal of the latter, and also that the former are much more numerous. There is good evidence that this breed was originally from Syria.

The following report regarding this breed is from David G. Fairchild, agricultural explorer of the United States Department of Agriculture:

The Zaráibi is the best milch goat known in Egypt and it is used largely by European families desiring pure milk for their infants. It not only gives more milk than

the ordinary kind, but is said to be a better breeder. I learned that the wealthiest landowner in Egypt had only recently purchased several for his own use. The best herd in Egypt is owned by the Khedive.

Mr. Fairchild was permitted to inspect the Khedive's herd of goats, a privilege seldom accorded to anyone. He believes they could with advantage be introduced into southern California in the warmer parts, but does not think they would live through the cold winters of the North unless housed very carefully. The climate to which they are accustomed is very much like that of southern California.

G. P. Foaden, secretary of the Khedivial Agricultural Society, forwards the following statement:

The Zaráibi goats are a race which was brought originally from Syria. They are superior to the native breed. They are now bred chiefly in the neighborhood of Cairo. A good average goat will give 4 pounds [quarts?] of milk per day and costs when full grown, if well bred, as much as £1.10 (about \$7).

The Syrian goat.—The writer is unable to find an authoritative description of the Syrian goat, but the evidence given by travelers in that country is convincing that, all things taken into consideration, this breed must take a place among the best breeds for milk production. It is always long haired and in color mixed black and white or solid black. Its ears are very long and pendulous, making it easy to believe that it is the original stock of the Zaráibi breed found in considerable numbers in the neighborhood of Cairo. The only available photograph (pl. 15, fig. 1) of this breed is the one given herewith, being one taken in Nazareth in April, 1904, by Mrs. Sallie Russell Reeves, of the United States Department of Agriculture. The flock shown here is owned by the German Orphanage and constitutes the only source of milk for that institution.

Dr. Ira Harris, who has been the American consular agent at Tripoli, Syria, for upwards of twenty years, has given the writer some interesting and valuable information regarding the Syrian goats, and some of the important parts are embodied in what follows:

This goat gives about 16 pints of milk a day, and the lactation period is usually nine months. It is a hardy breed, being kept all over Syria—on the plain, and on the mountain, where there is snow and frosty weather. "On the Hameth and Hums plain," says Doctor Harris, "they have a hot summer and a cold winter. I know of no other animal that has such a strong constitution unless it is a donkey." These goats are often seen in large flocks in Syria. Doctor Harris states that he has seen 2,000 kids in one flock.

It is likely that this breed could be easily acclimatized in the United States, and the low prices at which they can be purchased in Syria would seem to make it desirable for some one to consider the feasibility of importing some of them.

The Mamber goat.—The Mamber goat (*Capra mambrica*) is, according to Hoffmann, similar in many respects to the Cashmere [Angora?], but the horns, when they are present, are smaller. The ears are about three and one-half times as long as the head, are broad, thin, with the end rounded and turned up. The home of this breed is Asia Minor, especially in the vicinity of Aleppo and Damascus.

Hoffmann's description gives the impression that the Mamber goat is variously colored. The usual color is most likely black or brown, as it is probably closely related to the Egyptian and the Nubian goats.

The Sumatra goat.—The little that the writer has been enabled to obtain concerning the goats of the island of Sumatra is taken from Hook, who mentions them as scarcely larger than cats, and Hook says that, when contrasted with the large Pyrenean, the relation is much like that between the bantam and Cochin China fowls. It is hardly likely that there will be any desire to employ any of the Sumatra blood in building up a milch goat industry in the United States.

The Spanish-Maltese goat.—Under present conditions this goat would better be considered as among the American milch goats; but as they were bred as Spanish-Maltese several years before the other name was suggested, they will be treated separately here. (Pl. 4, fig. 3.)

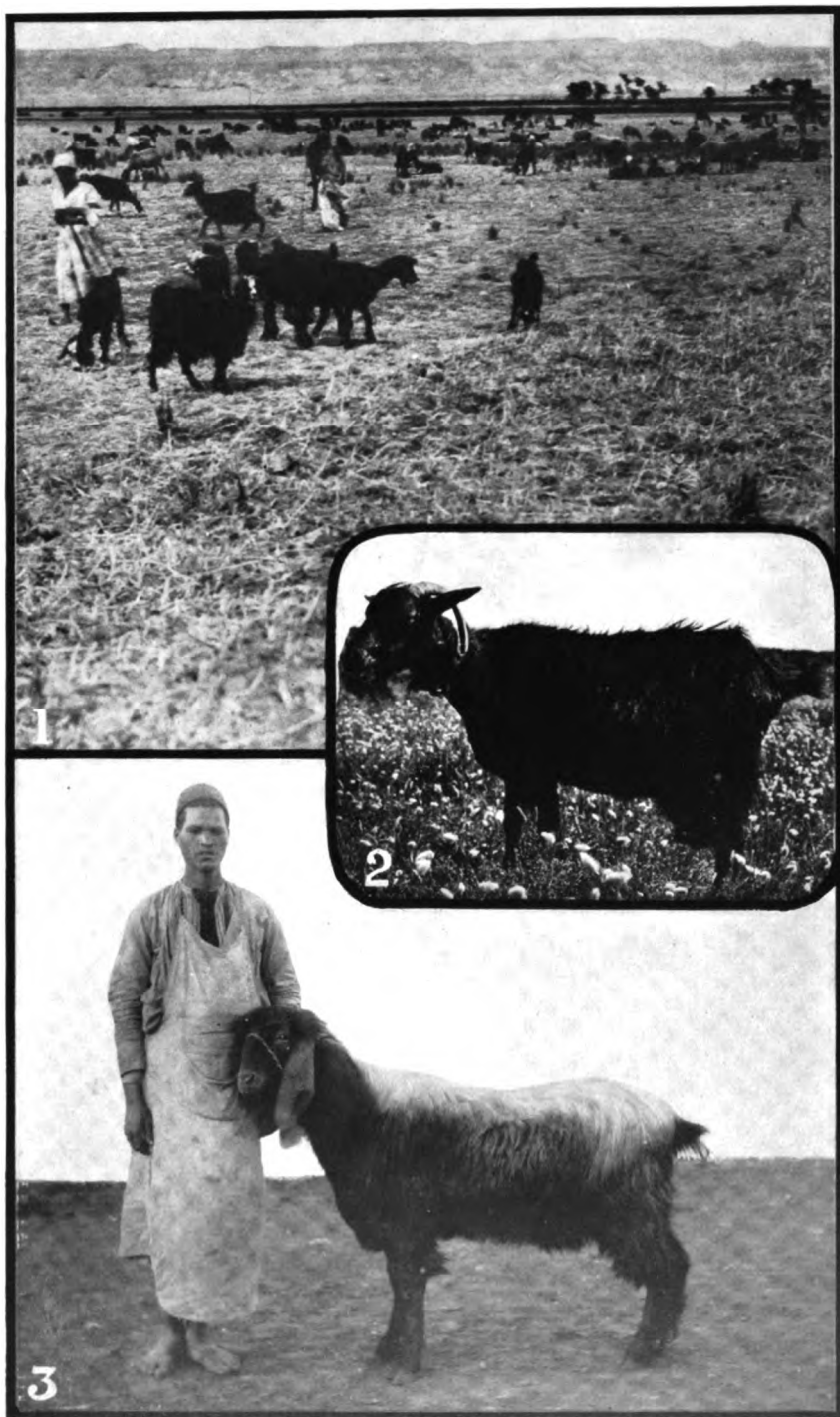
It is known that Spain at a former time received many goats from Malta, and it is claimed that some of these found their way to Mexico, and finally to Texas and New Mexico. Their history is difficult to trace accurately, however.

The following description of these goats is by B. H. Van Raub, of Texas:

The Spanish-Maltese goat is about the average size of the common or the Angora goat, possibly a little larger. It is white or grayish in color, but many have brown, bluish black, or reddish spots. Many have coarse hair, some have long, fine, silken hair, and some have short, coarse hair. As a rule they have pendulous ears. There are more hornless, or muley, goats among the Spanish-Maltese than among any other breeds.

It may be true that this particular strain is less inclined to produce horns than the common American goats, but it is not the case when considered in connection with the best breeds of Europe and Egypt.

There is no information available as to the quantity of milk that these goats will yield, although 2 quarts a day for some individuals has been estimated.



FIGS. 1, 2.—COMMON GOATS OF EGYPT. FIG. 3.—ZARAIBI GOAT.

Photograph of figs. 1 and 2 by David G. Fairchild.

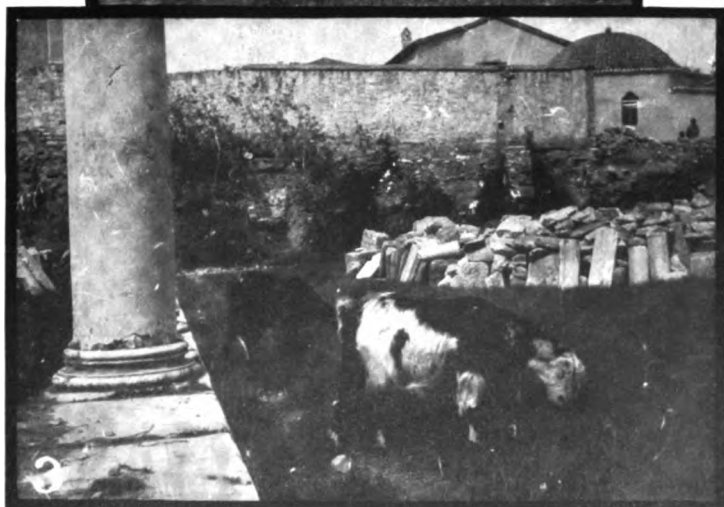
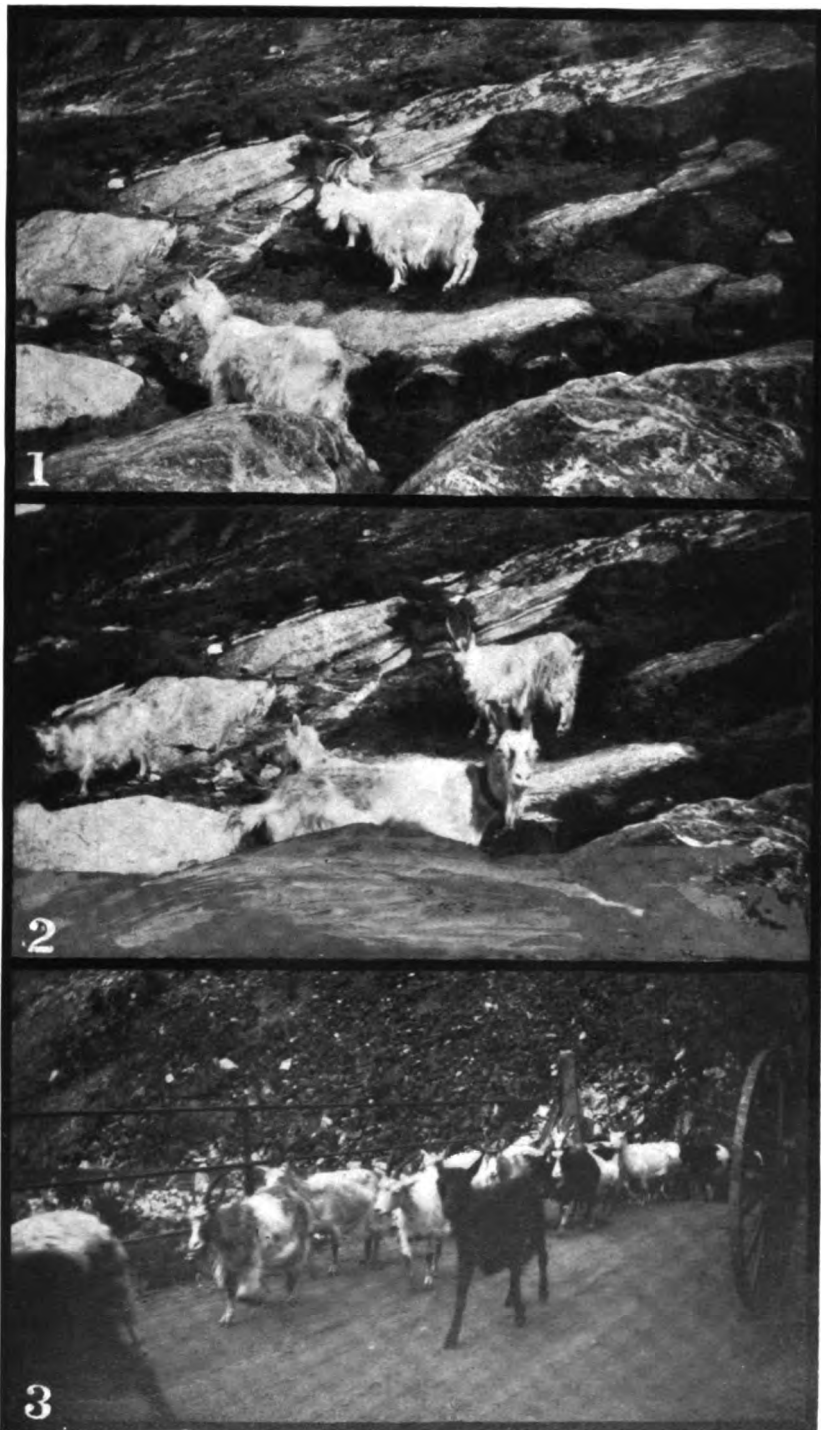


FIG 1.—SYRIAN GOATS AT NAZARETH. FIGS. 2, 3.—GOATS AT ATHENS.

Photographs by Sallie Russell Reeves.



FIGS. 1, 2.—GOATS NEAR HAMMERFEST, NORWAY. FIG. 3.—GOATS IN SOUTHERN NORWAY.

Photographs by Miss Caroline Myers.

THE MILCH GOATS OF SWITZERLAND.

By FRANK SHERMAN PEER,
Cornell Heights, Ithaca, N. Y.

In the spring of 1904, I had the pleasure of visiting Switzerland in the interest of several American gentlemen who wished to buy and import to this country some of the noted cattle and milch goats of that country. Armed with letters of introduction to the Swiss minister of agriculture, I arrived at Berne one day in March, full of delight at the magnificent scenery and anticipation of the work before me. The Swiss minister of agriculture sent me to the American consul as being the proper person to bring the questions before his department. The result was a letter to the president of the Swiss Agricultural Society, who in turn gave me letters to the best and most reliable breeders of milch goats in Switzerland.

It was soon learned that there were several breeds of goats in Switzerland, but that the best milking breeds were the Toggenburg, the Saanen, the Alpine, and the Schwarzthal,^a and of these the Toggenburg and Saanen goats were the best milkers. Therefore I confined my attention principally to the last two varieties.

All the breeds which I investigated are about the same size and weight, except the Saanen, which are about 25 to 30 per cent larger and heavier than the others. As to a choice between the Toggenburg and the Saanen, I like the Toggenburg better for a close-at-hand inspection and the Saanen best when seen in the field. There can be no prettier sight than a flock of Saanen goats on a hillside or in a green pasture.

In 1903, there were exported from Switzerland 50,000 francs' (about \$10,000) worth of Toggenburg goats, which speaks well for their popularity in foreign parts. Animals winning a prize are not allowed to leave the country or the neighborhood where raised for a year.

As to the quality of Toggenburg and Saanen goat's milk, so far as I could judge, there was no choice. They both give nice white milk, quite free from a goatly taste, which can not be said of all goats. It is seldom yellow and is probably the better for it. The best goat's milk, as I understand, is that which shows the greatest proportion of casein. Goat's milk in Switzerland is rarely made into butter.

^a Mr. Peer's descriptions of these several breeds are embodied in the text dealing with the breeds.—EDITOR.

The milk is considered good after the third milking, and the quantity rapidly increases for a few days after giving birth, when the maximum is reached. It usually continues for five or six months and sometimes for seven and eight months, when it gradually declines. A good goat may be expected to give 600 to 700 kilograms a year. The French feeding tests have proven that seven goats may be kept on the feed necessary for one cow, and that the seven goats will give much more milk than one cow.

GENERAL TREATMENT, FEED, AND CARE OF THE GOATS.

The goat of Switzerland is the Swiss peasant's cow, the Swiss baby's foster mother, a blessing to sanitariums for invalids, and a godsend to the poor.

Switzerland is a country of narrow valleys and lofty mountains. The winters in most parts are long and severe. The valleys are devoted to hay and grain to support the farm stock through the winter, while the foothills and mountains are the pasture ground during the summer months.

The highest mountains are covered with perpetual snow. Winter in the Saane and Toggenburg valleys sets in about November 1, and the ground from about that time until nearly May is covered with snow. When the writer visited there in March last the snow was from 3 to 6 feet deep on the level. Scattered all over the vale and on the foothills are little barns filled with hay, and this is either brought on hand sleds to some stable near the house, which, as a rule, is a part of the house, or the stock are moved from one barn to another, in turn, as the feed gives out. There are no large herds of goats owned by a single man or company, but nearly everyone has from 1 to 6. Ten or a dozen goats are considered a very large flock. The goats in winter occupy a portion of the cow barn or horse barn, or some warm stable adjoining the kitchen. As a rule, neither cattle nor goats go out of their stalls from the day they are put in in the autumn until the following spring.

The cows are usually fresh in the autumn after they come into winter quarters. Winter dairying is the universal practice. The goats drop their kids in the spring, beginning in March. About May 20, when the snow is gone from the valleys and the lower foothills, the larger herds of cattle are taken from the stalls and bells of different sizes and notes are put on their necks. One, called the "bell cow," wearing the largest bell of all, leads forth the herd to pasture. Together with this herd of cattle and goats, which belong to some larger farmer or breeder, go the cows and goats of a dozen or more neighboring peasants.

A cow man, with the "big bell" cow as leader of the flock, starts for the pasture fields; several boys go along as assistants. It is a great

day of rejoicing for cattle and goats and kids alike, after their long winter confinement. The gaily dressed cow men, the chorus of the bells, the sporting calves and skipping goats all make a very interesting spectacle indeed. These animals go yearly to certain locations on the foothills, and, as the snow gradually disappears, they keep moving the herd higher and higher up the mountains until midsummer, when they arrive at the limit of vegetation and shortly after begin the descent, and about November 1 they are all back in the stables again for the long winter.

Dotted all over these lofty mountain ranges are little huts which are the headquarters of the cow men and boys while herding in that particular vicinity. Once or twice a week someone goes to the valley to renew the larder with dried fish, canned meats, and bread.

There are scattered over these mountain ranges little creameries mostly for making cheese. The milk from the goats is mixed with that from the cows and made into cheese. In some cases, however, the calves born the autumn before are allowed to suckle their dams while in the mountains and the goat's milk with a little cow's milk only is made into cheese. There are therefore many brands of this mountain-made cheese, differing largely only in the proportion of cow's milk to goat's milk. The process of making these different kinds of cheese is generally the same.

Goats and cows seem to work well together on these summer pilgrimages above the clouds. The goats oftentimes go where cows can not, and they live largely on twigs and shrubs, which the cows do not eat.

The winter feed of the goats consists of a small wisp of hay daily and possibly a handful of oats or other mixed grains. As a rule, they do not get any more than sufficient to keep them in very ordinary condition.

As to prices, Toggenburg goats from 1 to 2 years old in March, before dropping their kids, cost \$12 to \$15 per head; bucks, \$15 to \$25. Saanen goats of the same age cost from \$3 to \$10 per head more, and Alpine goats from \$3 to \$5 less, than the Toggenburgers. The Schwarzthal, or Glacier, goats cost from \$15 to \$20 for females and from \$20 to \$40 for males. Cheaper grades of goats, such as are usually exported through local dealers, may be had, but they are usually the culls.

Treatment of kids.—As a rule, the goats of Switzerland are allowed to breed only once a year, but where it is desirable to obtain the greatest yield of milk and the most increase, they may bring forth their young three times in two years. By this system the yield of milk is increased to an average of 1,000 kilograms (2,200 pounds) per year. The kids are usually allowed to suckle their dams for a day or two, the first milk being very necessary to the healthful movement of

the young kid's bowels. Twins are the rule, and sometimes triplets, and occasionally four kids are dropped at a birth. The best breeders prefer that the females be 2 years old when they drop their first kids; but they will breed younger.

When a young doe gives birth to twins she is generally assisted in rearing them by a nursing bottle and cow's milk, which is diluted nearly half with water and slightly sweetened. Usually, with a number of fresh milch goats on hand, the kids are separated from the dam (in fact, they are rarely ever allowed to run with their dams) and are taken one at a time and put upon another doe, so as to divide the quantity of goat's milk in accordance with their wants or age. When cheese making is the object, it is planned to have a fresh cow to bring up the kids, as above described, beginning always with goat's milk and reducing the quantity and increasing cow's milk and water as the age of the kid will permit.

Feed.—This milk feeding goes on for five or six weeks, when most of the kids are weaned from milk altogether. They are given a small quantity of hay to pick at when a few days old. The best breeders in Switzerland say that buckwheat flour, corn (maize), and a little warm water make the best grain ration for milch goats. Oats, ground and whole, are also fed.

SWISS MILCH GOATS IN AMERICA.

There are many reasons why the milch goats of Switzerland should find a welcome in the United States. First, their milk is the nearest to that of human mothers, or, at least, is such that the most delicate stomach can retain it. It can generally be taken freely where cow's milk would not be tolerated. In connection with sanitariums and for use in all acute stomach troubles, these goats fill a want that can not be estimated by dollars and cents. In this way probably they will find a footing in this country. They are the poor man's cow, as has been said before, and thousands of laboring men would find them a luxury for their homes and a godsend to their families.

The trouble will be that in this country the goat has so long been an object of ridicule among those who never understood its value that a false impression has sprung up among laboring men that is prejudicial to the keeping of goats. There are thousands of homes, especially in the mining districts, where herds of goats could be driven away in the morning and returned at night; and they would supply the homes with a most nutritious and most healthful beverage and food at a trifling cost.

Points.—In selecting any kind of milch goats there are some general rules that may govern. One of the most common faults is an inclination of the hocks, which causes the hind feet to turn, or toe, out.

Quality or fineness of hair is usually demanded; also thickness of coat. Another fault which is noticed among animals (on account of in-and-in breeding or neglect) is a dropping away behind the shoulders. Goats should have deep, full breasts, strong loins, broad backs, deep bodies, and large stomachs; these are the general requirements. Then comes color markings, and all that goes to constitute family type in each particular breed.

When we realize the wretched stabling and scanty feeding in Switzerland, it may confidently be expected that the goats will be greatly improved in every respect by good care, proper ventilation, and by liberal feeding. By such rational treatment they should be brought to a much higher state of perfection as milk producers.

Soil.—Neither a goat nor a sheep will thrive on soil that is at all damp unless thoroughly drained. While goats are said to live on anything or nothing, they are even more fastidious than sheep. They require a wide range. They pick the tenderest bits of grass and buds, and when they have fed over a ground once or twice the taint from their own bodies makes the pasture objectionable to them, and they keep on feeding there only by stress of hunger. Where a wide, hilly range or frequent change can not be given, they should be tethered and not allowed more pasture to go over in a day than they will eat. In this way they may always have fresh, untainted forage within a very small inclosure, or, better still, where a wide range can not be given they may have the run of a small inclosure and be fed soiling crops in the stalls during the day. In hot weather they should have stalls darkened to exclude the flies in the daytime and the liberty of a yard, paddock, or field at night. In spring and autumn they could go out in the daytime and remain in at night.

It must be remembered that goats are very sensitive animals, and, while they are, in jest, said to live on air and snow, they are, in reality, very susceptible to sudden changes of climate, cold storms while at pasture, and drafts while stabled. While they have a great stock of vital energy, their milk supply is more easily affected by sudden change and exposure than that of either cattle or sheep. In Switzerland the goats of the best breeders are housed at night, even after they go out to pasture, until the weather is thoroughly settled, when they are fed soiling crops by day and go out by night.

Stabling.—The milch goat has already attained quite a degree of popularity in England, and, while visiting that country during late years, I have seen some very complete stables and stalls, which seem to meet all requirements. The prime object in building a goat stable is, first of all, absolute dryness; stone basements or masonry walls, unless built hollow, should be avoided; second, ventilation, or plenty of fresh air without draft.

GOATS IN NORWAY AND SWEDEN.^a

By CAROLINE HARRISON, M. S.,
Of the Bureau of Plant Industry.

According to the live stock census, the entire number of goats in Sweden in 1900 was 80,000; of these, 2,687 were exported. The law in most provinces forbids small farmers and laborers to allow goats to graze in the woods, and this has probably been the cause of the decrease from some 200,000 in 1850 to the present number. About half of the goats of Sweden are to be found in the western provinces, Delarne and Jemtland.

Norway is a primitive as well as a very poor country, and yet education takes a surprisingly high rank. All the fishermen along the coast can not only read and write, but they write articles for the current papers that need little or no editing. They all have telephones in their huts and can call help, as they often do, if a catch is too large to manage with the help at hand. All along the precipitous western coast from the capital to the North Cape—a distance, if indentations are measured, of 1,700 miles—these fisher people were found, and all appeared to keep one or more goats. The larger numbers of goats, however, are to be found inland, in the narrow valleys, particularly in Gudbrandsdalen.

While the average mountain is about 3,000 feet high, yet so common are these mountains that there is left only 3 per cent of arable land in the entire country. Wild Norway is really an ideal goat pasture; and the little ground that can be cultivated is found along the rims of the fjords that carry the sea inland sometimes more than a hundred miles. These fingers of the ocean are so deep that large steamers may go within a few feet of the mountain side. From the steamer we often saw goats, sheep, and cows very distinctly on both sides. These mountain sides are covered with a low growth of the European birch (*Betula alba* L.) and the dwarf birch (*Betula nana* L.), the foliage of which the goats eat as far as they can reach.

^aMiss Harrison and Miss Caroline Myers, of the Department of Agriculture, made a trip through Scandinavia, covering the period of April 29 to July 28, 1904. The object was scientific investigation as well as recreation. This article gives the results of only a part of the work undertaken.—EDITOR.

The farming in Norway is for the most part done by the women, while the men go to sea, fish, or engage in other occupations. There is very little exchange of products, so that a variety of goat might be found in one province and not appear again in all Norway. For those who contemplate the purchasing of stock it would seem best to visit the annual fairs which are held in Christiania, Bergen, and other cities, the exact dates of which may be obtained from our consuls. The Government distributes the prizes, which are certificates of merit. The Government also exhibits animals as models of the standards to be attained. The Emperor of Germany sends his buyers to these fairs to purchase horses, and it would seem to mean as much in the selection of goats as of horses.

The goats, as well as the cows and sheep, are taken to the mountain farms—"saeters," they are called—for the summer. In early spring the grazing is done in the valleys; about the first of June the herd is taken part way up the mountain by the saeter girls. A summer house, with all appliances for butter making and cheese making, is kept here from year to year. As the summer advances and feed grows scarce, the stock is moved up to another farm, and so on until fall, which begins in September.

In winter the goats are housed in the warmest and most carefully kept stables. For winter food potato tops, birch leaves, and many other things are cooked up into all kinds of warm teas and soups for goats and other animals. The people of Norway love their animals, and during our stay in all Norway we saw not a single animal in poor condition.

Norway has two kinds of cheese made from goat's milk—one brown, made from whey, and one white, made from the milk. The brown one looks and tastes to an American like brown soap. They are both called "gjitost." "Gammelost" (old cheese), the national cheese of Norway, ripened underground and smelling so strong that Limburger is a fragrant bouquet in comparison, is not a goat's cheese, as generally thought by travelers, but made from cow's milk.

We always had a large number of varieties of cheese at breakfast, which were served in very attractive ways—with hand-worked bands of linen or doilies, and the whole put under bell jars.

The temperature of Norway varies with the altitude and is very different on the coast from the inland. The Gulf Stream modifies the western coast to a remarkable degree. On the coast and in the southern part the mean annual temperature is 44.5° F., and at altitudes of 3,000 feet is 31° F. July is the warmest month, with a mean temperature of 61° F. In September and October the temperature falls rapidly, but it is not until November that the mean temperature of the day falls below the freezing point. December, January, and February are the coldest months. The mean winter temperature at

Christiania is 32° F., and far up the coast it is often not lower than 4° F. Inland it is much colder.

The annual rainfall is varied, being on the coast 48 inches and at many stations inland not more than 12 inches. Norway is not so cold as its latitude on the map would indicate, and the temperatures are constant. During our trip, in June, to the North Cape the thermometer kept steady between 48° and 50° F.

Hammerfest is farther north than any other town in the world, being $70^{\circ} 40' 11''$ north latitude and $23^{\circ} 45' 25''$ east longitude. Around Hammerfest are swamps, and just behind the town rises a small mountain to the height of 1,300 feet—about as high as Mount Lowe, in southern California. We observed the goats, which were white, about 800 feet up. The only thing seen which they might eat was the dwarf birch (*Betula nana* L.) and a willow (*Salix arctica* Pall.) not more than 2 feet high. While we were there, the 21st, 22d, and 23d of June, we could sit on the hillside and pick violets with one hand and make a snowball with the other. The sun's rays come straight down and prick like needles. The sun does not set from the 13th of May until the 29th of July, and with twenty-four hours of sunlight growth is rapid. The mouth of the Alten Fjord extends to near Hammerfest, and is reached by boat every day during the summer.

On the Stalheim road, some 4 or 5 miles from Gudvangen, we saw, besides individual goats, a herd of some 300 or 400 in the care of two young peasant girls. The road is in the Naeroedal, a valley exceedingly narrow, flanked with steep mountains of great height. This is one of the best valleys for goats in Norway.

The facilities for getting about in Norway are excellent. The roads are all owned by the Government, and are perfect. The horses and carriages are controlled by Government regulation, and the stations furnish large rooms, with excellent, clean beds. The simple food is well cooked and served in good order. The telephones and telegraphs are cheap, convenient, well managed, and everywhere available. American money, in bills not exceeding \$10, is preferred to Norwegian money, because it is wanted for emigrants. While it is always an advantage to know the language of a country, yet for all business purposes almost everyone speaks some English. Besides, the Norwegian language has a simple construction like our own, and enough to get on with is easily learned.

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INDEX.

	Page.
Abyssinian, or Nubian, breed, description.....	66-69
African, or Widah, breed, description.....	70
Age—	
how to determine	44
to breed	39
Albrecht, von L., remarks on milking.....	23
Albumin—	
percentage in goat's and cow's milk.....	19
percentage in whey.....	27
Alpine goats, description.....	63
American goats, description.....	50
Appenzell breed, description.....	57
Ash and salts, percentage in the butter.....	26
Barn—	
and yard, description.....	30
suggestions for bedding.....	32
Bedding, suggestions.....	32
Breeding—	
age, discussion.....	39
in-and-in, remarks.....	41
methods.....	37-39
proper time.....	39
Breeds, different kinds, description.....	50-72
Brushwood, goats as destroyers.....	46
Buck—	
remarks on breeding.....	37
suggestions for management.....	29
Butter, remarks; composition	26
Carbohydrates, percentage in the butter	26
Casein, percentage in goat's and cow's milk	19
Cheese, remarks.....	25, 26
Chisholm, J. R., remarks on goats in Queensland	13
Climate and soil suitable for goat raising	13
Coligny, Wm. G. de, description of Nubian breed	68
Cow's and goat's milk, composition.....	19
Dairies, discussion.....	24
Decker, Wm. More, remarks on milking.....	22
Dettweiler, Fr.—	
remarks on flavor of the milk	21
remarks on immunity of goats from tuberculosis.....	28
remarks on uses of the milk in Germany.....	12, 13
remarks on yield of the milk	18

	Page
Deutsch Landwirthschaftliche Presse, remarks on the milk	29
Diseases, remarks	27
Doe—	
remarks on breeding	38
suggestions for management	29
Dogs worrying goats	48
Dry substance, percentage in goat's and cow's milk	19
Dwarf goat, note	70
Egyptian, or Nile, breed, description	69
English goat, description	65
Fairchild, David G., remarks on Zaraïbi breed	70
Fat—	
percentage in goat's and cow's milk	19
percentage in the whey	27
percentage in the butter	26
Feed, proper kinds	34-37
Fences, description	33
Fertilizer, value	47
Flavor and odor of the milk	20, 21
Fleischmann, remarks on yield of the milk	18
Flesh as food, remarks	45
Foaden, G. P., remarks on Zaraïbi breed	71
Gassenay breed, description	60
Germany—	
remarks on goat keeping by authorities	12
value of goats and goat products, 1892	10
Goat—	
keeping, economy	12
transportability	23
Goats—	
and cow's milk, composition	19
and goat products of Germany, value in 1892	10
as brushwood destroyer	46
in Norway and Sweden, article by Caroline Harrison	78-80
in Switzerland, feed and care	74-76
management	29
number in Switzerland, 1901	10
prices in Switzerland	75
where to purchase	42, 43
Guggisberger breed, description	60
Hardiness—	
causes	41
remarks by Pegler	42
Harris, Ira, remarks on the Syrian goat	71
Harrison, Caroline, article on "Goats in Norway and Sweden"	78-80
Harz Mountain breed, description	60
Hilpert, Felix—	
remarks on immunity of goats from tuberculosis	28
remarks on utility of goats	13
Hinterwald breed, description	62
Hoffmann, Fr.—	
description of Mamber breed	72
remarks on goat keeping in Germany	12
remarks on immunity of goats from tuberculosis	28

Hoofs, remarks on care	34
Hook, Bryan—	
description of Irish goat	66
description of Schwarzthal breed	57-58
description of stalls	31-32
remarks on flavor of the milk	20
remarks on immunity of goats from tuberculosis	28
remarks on the milk	16
Horns, discussion	47
Hungarian breed, description	63
Immunity of goats from tuberculosis	27-28
Importations and importing	48
In-and-in breeding, remarks	41
Irish breed, description by Pegler and Hook	66
Journal of Medicine (Paris), remarks on the milk	16
Kids—	
methods of raising	40
number at a birth	39
treatment in Switzerland	75
Kloepfer, G.—	
remarks on feeding	36
remarks on flavor of the milk	21
Lactation period	21, 22
Langensalzaer breed, description	59
Maltese breed, description	51-53
Mamber breed, description by Hoffmann	72
Medical Times, remarks on the milk	16
Milch—	
goats of Switzerland, article by F. S. Peer	73-77
Zeitung, remarks on flavor of the milk	21
Milk—	
characteristics	17
consideration	14-15
flavor and odor	20-21
of goats and cows, composition	19
production and value in Switzerland, 1901	10
remarks by authorities	16
yield, discussion	17-19
Milking—	
breeds, best, of Switzerland	73
description of operation	22, 23
Modern Medicine, remarks on the milk	16
Nile, or Egyptian, breed, description	69
Norway and Sweden goats, article by Caroline Harrison	78-80
Nubian, or Abyssinian, breed, description	66-69
Odor and flavor of the milk	20-21
Peer, F. S., article on "Milch goats of Switzerland"	73-77
Pegler, H. S. Holmes—	
description of buck for breeding	38
description of English goat	65
description of Irish goat	66
description of Welsh goat	66
remarks on feeding	36

Pegler, H. S. Holmes—Continued.	Page.
remarks on flavor of the milk	20
remarks on hardiness	42
remarks on the milk	16
remarks on yield of the milk	19
remarks on value of the skins	45
Petersen, Peter—	
remarks on goat keeping in Germany	12
remarks on yield of the milk	18
Prices—	
of goats in Switzerland	15
of goats, remarks	43
Proteids, percentage in the butter	26
Purchasing goats, suggestions	42, 43
Pyrenean breed, description	64
Queensland, remarks by J. R. Chisholm on goat keeping	13
Renesse, A. von—	
remarks on immunity of goats from tuberculosis	28
remarks on manufacture of cheese	26
remarks on milking	23
Registration associations	49
Richman, Irving B., remarks on the milk in Switzerland	16
Saanen breed, description	55-57
Salting, remarks	33
Salts—	
and ash, percentage in the butter	26
percentage in the whey	27
Saxony breed, description	61
Schwartz, Doctor, remarks on immunity from tuberculosis	28
Schwarzthal breed, description	57-58
Schwarzwald breed, description	58
Skins, value	45
Soames, H. Aldwin, remarks on feeding	37
Soil—	
and climate suitable for goat raising	13
suitable for goats	77
Spanish—	
goats, remarks	65
-Maltese goat, description by B. H. Van Raub	72
Stabling necessary	77
Stalls suitable	31
Starkenbourg breed, description	60
Sugar—	
percentage in goat's and cow's milk	19
percentage in the whey	27
Sumatra breed, remarks	72
Sweden and Norway goats, article by Caroline Harrison	78-80
Swiss goats in America, suggestions	76
Switzerland—	
milch goats, article by F. S. Peer	73-77
number of goats, 1901	10
production and value of the milk, 1901	10
remarks on goat's milk, by Irving B. Richman	16
value of exports of Toggenburg goats, 1903	73

	Page
Syrian breed, remarks by Ira Harris.....	71
Tarentaise goat, description	64
Toggenburg—	
breed, description	53-55
goats, value of exports from Switzerland, 1903.....	73
Tuberculosis, immunity of goats.....	27-28
Van Raub, B. H., description of Spanish-Maltese goat	72
Welsh goat, description.....	66
Westphalian breed, description	62
Whey—	
composition	27
uses	26
Widah, or African, breed, description	70
Wiesenthal breed, description.....	61
Water—	
percentage in goat's and cow's milk	19
percentage in the butter	26
percentage in the whey	27
remarks	34
Wattles, remarks.....	47
Watts, Col. I. Washington, remarks on yield of milk of Angora	18
Yard and barn, description	30
Zaraïbi breed, description.....	70
Zürn, E. S.—	
remarks on flavor of the milk	21
remarks on yield of the milk.....	18

[Concluded from page 2 of cover.]

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U. S. DEPARTMENT OF AGRICULTURE,

BUREAU OF ANIMAL INDUSTRY.—Bulletin No. 69.

D. E. SALMON, D. V. M., Chief of Bureau.

THE EXTERNAL PARASITES OF HOGS,

BEING ARTICLES ON

THE HOG LOUSE (*Hæmatopinus suis*)

AND

MANGE, OR SCABIES, OF HOGS.

BY

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Zoological Laboratory, Bureau of Animal Industry.



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LETTER OF TRANSMITTAL

UNITED STATES DEPARTMENT OF AGRICULTURE,
BUREAU OF ANIMAL INDUSTRY,
Washington, D. C., January 28, 1905.

SIR: I have the honor to submit herewith a paper entitled "The External Parasites of Hogs," by Earle C. Stevenson, of the Zoological Laboratory of this Bureau, and to recommend its publication as a bulletin.

This paper deals with two enemies of the hog—the hog louse, and mange, or scabies, of the hog. The first of these enemies especially, the hog louse, is one with which every hog raiser is familiar, and one that he has been forced to tolerate because he knew of no satisfactory cheap method of getting rid of the lice. This paper is designed, not only to give a technical description of the hog louse and the scab mite, but to give advice as to how to get rid of the lice and the mites and practical suggestions growing out of actual experience.

Respectfully,

D. E. SALMON,
Chief of Bureau.

Hon. JAMES WILSON,
Secretary.

CONTENTS.

	Page.
Introduction	7
The hog louse (<i>Hæmatopinus suis</i> (Linnæus, 1758) Leach, 1817).....	9
Brief historical review	9
Synonymy	10
Classification.....	11
Geographical distribution	12
Description	12
Egg of the hog louse.....	15
Injurious effects of the hog louse.....	16
Treatment for the hog louse	17
Preventive measures	17
Treatment of the hogs	18
Formulas of oil emulsions.....	20
Mange, or scabies, of hogs.....	23
Cause of mange.....	23
Sarcoptic mange.....	23
Description	24
Reproduction	24
Symptoms	24
Contagion	24
The injurious effects of mange.....	25
Treatment	25
Remedies	26
Ointments	26
Liquid preparations.....	26
Demodecic mange	27
Application of remedies.....	29
Dipping	29
Spraying.....	33
Bibliography.....	35

ILLUSTRATIONS.

	Page.
FIG. 1. Dorsal view of female louse.....	9
2. Dorsal view of male louse.....	10
3. Ventral view of last three abdominal segments of male louse.....	12
4-8. Cross section of stylet, or so-called sucking-tube, of louse.....	13
9-11. Basal parts of stylet.....	13, 14
12. Dorsal view of everted proboscis, showing the hooks and also the parts of the protruded stylet.....	14
13. Claw of hog louse.....	15
14. Egg of hog louse.....	15
15. Shell of egg from which the young louse has escaped.....	15
16. View of outer surface of egg shell.....	16
17. View of inner surface of egg shell.....	16
18. Dorsal view of female mite (<i>Sarcoptes scabiei</i> var. <i>suis</i>) causing sarcoptic mange.....	23
19. Dorsal view of male mite (<i>Sarcoptes scabiei</i> var. <i>suis</i>) of sarcoptic mange.....	24
20. Egg of mite of sarcoptic mange.....	24
21. Ventral view of male mite (<i>Demodex folliculorum</i> var. <i>suis</i>) causing follicular mange.....	27
22. Ventral view of female mite of follicular mange.....	27
23. Egg of mite of follicular mange.....	27
24-25. Plans for dipping tank.....	30, 31
26-28. Simple spraying apparatus.....	32, 33
29. Sectional view of oak post to be saturated with kerosene for use as a rubbing post for lousy hogs.....	34

THE EXTERNAL PARASITES OF HOGS.

By EARLE C. STEVENSON, B. SC., A. M.,
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INTRODUCTION.

In most of the published works on hogs and the prevention and treatment of their diseases the subject of external parasites is disposed of within the brief space of one or two pages, and the very short notes given on the prevention and destruction of these pests are no doubt due to the tendency to underestimate the economic importance of these parasites, for the reason that the injurious effects they produce are not always recognized as being of parasitic origin. The poor condition of health and stunted growth of some droves of hogs in a locality where other herds thrive on practically the same food and care is very frequently observed, particularly among young animals. This unhealthy condition may result from various causes. Observation and experiment, however, have demonstrated that not infrequently the trouble is to be traced to the presence of parasites on the skin of the animals. These parasites produce a diseased condition of the skin, annoy and irritate the hogs, and, in spite of excellent care and good food provided for them, interfere with the general health and growth of the animals. The injurious effects have been known to become so severe as to cause death to young pigs.

The three principal external parasites of the hog are the large louse (*Hæmatopinus suis*), the small itch mite (*Sarcoptes scabiei* var. *suis*), and the minute mite of follicular mange (*Demodex folliculorum* var. *suis*). Other external parasites have been noted by Jarvis (1904), who found in the Umtali District, South Africa, a number of ticks on hogs that were suffering from a disease known as "porcine malaria." This disease is said to be most prevalent during the rainy season, when ticks are most abundant. These ticks were determined as *Amblyomma variegata* (misprint for *variegata*), *A. flava*, *Rhipicephalus appendicularis* (misprint for *appendiculatus*), and *Rhipicephalus* sp.?

Demodex folliculorum is of common occurrence, but seems to be of little economic importance to the farmer. It is found buried deep in the follicles of the skin and does not yield to ordinary treatment. *Hæmatopinus suis* is the largest representative of its family, and it

forms the principal subject of this discussion. *Sarcoptes scabiei* var. *suis* not infrequently becomes more injurious than the hog louse and therefore is of considerable economic importance.

The scope of this article includes a review of the literature on the subjects of lice and mange of hogs, a record of the new experiments performed, and a more complete account of the large louse (*Hæmatopinus suis*). (For Bibliography, see p. 35.)

THE HOG LOUSE.

(*Hæmatopinus suis* (Linnæus, 1758) Leach, 1817.)

BRIEF HISTORICAL REVIEW.

Mouffettus (1634, p. 265) mentions the hog louse and refers to Albertus (twelfth century) as having named it *Pediculus urius*, from the Latin word "urendo," meaning "to irritate." This early historical reference places the hog louse among the oldest recognized species of parasitic insects. Linnæus (1758) described it under the name *Pediculus suis*. Panzer (1798) used the name given by Linnæus, and states that Fabricius classed this parasite with *Pediculus asini* of Redi (1671). This reference to Fabricius, cited by Panzer, is not at hand, but in a later publication (1805) Fabricius gives the synonymy corresponding to the statement of Panzer. A comparison of Redi's figure of *Pediculus asini* with a specimen of *Hæmatopinus suis* shows a striking resemblance between the two, but Linnæus based in part his species *Pediculus asini* on Redi's figure and Panzer disregarded the classification of Fabricius. Leach (1817) subdivided the genus *Pediculus* into four genera—*Phthirus*, *Hæmatopinus*, *Pediculus*, and *Nirmus*—classing the hog louse as type of the new genus *Hæmatopinus*. Nitzsch (1818) revived the specific name *urius*, combining it with the generic name *Pediculus*. Giebel (1874), in describing the parasite, named it *Hæmatopinus urius*.

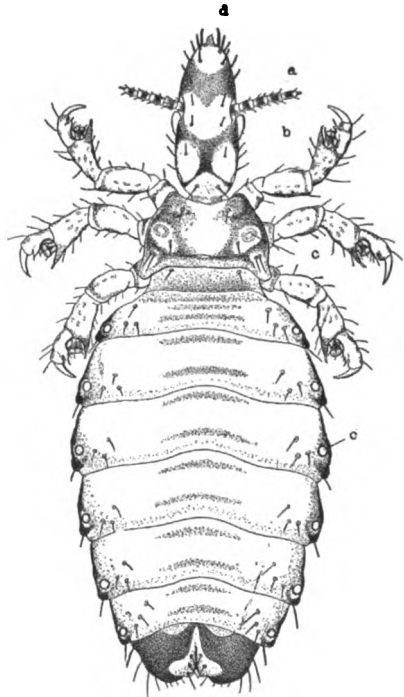


FIG. 1.—Dorsal view of female hog louse. $\times 15$.
a, antennæ; b, eye; c, spiracles; d, proboscis or haustellum.

SYNONYMY.

The historical account given above shows the correct name of the hog louse, according to the rule of priority, to be *Hæmatopinus suis*. It has, however, received various designations as is shown by the following synonymy, which includes the different names under which this parasite has been known, together with the authors and their dates:

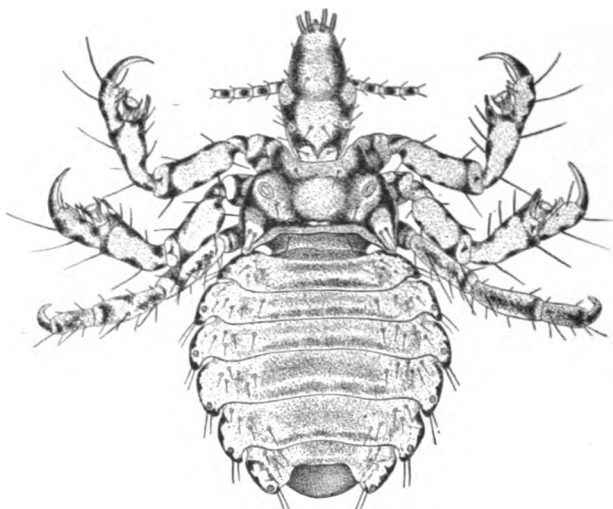


FIG. 2.—Dorsal view of male hog louse. × 15.

- 1758: *Pediculus suis* LINNÆUS, 1758, p. 611; 1798, v. 3, p. 18.—MUELLER, 1764, p. 90; 1776, p. 184.—CUVIER, 1817, p. 165.—PANZER.—[1798], pl. 16, FABRICIUS, 1805a, p. 342.—DE OLFERS, 1816, p. 86. [As synonym of *Hæmatopinus suis* in LEACH, 1817, p. 66.—SAMUELLE, 1819, p. 143; 1824, p. 143.—STEPHENS, 1829, p. 329.—DENNY, 1842, p. 34; 1852, p. 4.—WALCKENAER, 1844, p. 306.—CUVIER, 1851, p. 489; [?] (*Les Insectes*), p. 74.—RAILLIET, 1895, p. 831.] [As synonym of *Pediculus urinus* in NITZSCH, 1818, p. 305.—BURMEISTER, 1838, p. [13]; 1847, p. 577.] [As synonym of *Hæmatopinus urinus* in GIEBEL, 1874, p. 45.—PIAGET, 1880, p. 654.—TASCHENBERG, 1880, pp. 103, 105, 106.—ZITERN, 1882, p. 65.—PICAGLIA, 1885, p. 146.—OSBORN, 1891, p. 19; 1892, p. 205, pl. 1, fig. 5.]
- 1817: *Hæmatopinus suis* (LINNÆUS, 1758) LEACH, 1817, p. 65, 66, pl. 46 [first use of name was in *Encycl. Brit.*, Suppl. 1, p. 24, ? 1810].—SAMUELLE, 1819, p. 143; 1824, p. 143.—STEPHENS, 1829, p. 329.—DENNY, 1842a, p. 7, 34, pl. 25, fig. 2; 1852, p. 4.—GURLT, 1843, p. 12, pl. 1, fig. 11; 1857, p. 281-309; 1878, p. 165.—GRUBE, 1854, p. 242.—GERVAIS & VAN BENEDEN, 1859a, p. 382, fig. 81.—GERSTÆCKER, 1863, p. 307.—VERRILL, 1870, p. 112; [1871], p. 41, fig. 39.—PACKARD, 1873, p. 102, fig. 120.—HURTREL, 1875, p. 286, fig. 962.—MURRAY [1877], p. 386.—LAW, 1877, p. 284, 285, fig. 1.—COBBOLD, 1879, p. 414.—LANESSAN, 1882, p. 525.—WEST, 1882, p. 148, pl. 15, figs. 1-4.—LINTNER, 1882, p. 48.—PERRONCITO, 1882, p. 486, fig. 209; 1886, p. 333; 1901, p. 599.—GRIFFITH & HENFry, 1883, p. 369, pl. 35, fig. 4.—UHLEH, 1884, p. 294.—RAILLIET, 1886, p. 586; 1895, p. 831, fig. 570.—BROCCHI, 1886, p. 837, fig. 532.—FRIEDBERGER & FROEHNER, 1886, p. 632; 1895, p. 90.—POWER & SEDGWICK, 1886, p. —.—LUDWIG, 1886, p. 480.—COMSTOCK, 1888, p. 132, fig. 118.—

- GILLETTE, 1889, p. 286, fig. 26; 1890, p. 47, figs. a-d.—SIEDAMGROTZKY, 1889, p. 296.—BLANCHARD, 1890, v. 2, p. 436, fig. 675.—BRANDT, 1890, p. 96, fig. 79.—OSBORN, 1891b, p. 191.—BOS, 1891, p. 659.—BROWN, 1895, p. 60, fig. 35.—BLANCHON, 1899, p. 249.—GALLI-VALERIO, 1901, p. 349.—GUENAU, 1904, p. 454, fig. 299. [As synonym of *Hæmatopinus urius* in GIEBEL, 1874, p. 45.—PIAGET, 1880, p. 645.—ZÜRN, 1882, p. 65.—PICAGLIA, 1885, p. 147.—NEUMANN, 1888, p. 64, figs. 23, 30; 1892, p. 72, 73, figs. 25, 26.—GALLI-VALERIO, 1896, p. iii.] [As synonym of *Pediculus suis* LINN. in WALCKENAE, 1844, p. 306.] [As synonym of *Hæmatopinus irritans* in LAW, 1903, p. 13.]
- 1818: *Pediculus urius* NITZSCH, 1818, p. 305; 1852, p. 130.—BURMEISTER, 1838, p. [13], pl. [1] Phthirius, fig. 4, pl. [2] Pediculus, figs. 9, 10, 13, 14; 1847, p. 577-578, pl. 1, figs. 1-10.—SCHIODT, 1864, p. 50; 1866, p. 215. [As synonym of *Hæmatopinus urius* in GIEBEL, 1874, p. 45.—PIAGET, 1880, p. 654.—PICAGLIA, 1885, p. 146.] [As synonym of *Hæmatopinus suis* in STEPHENS, 1829, p. 329.—Denny, 1842, p. 34; 1852, p. 4.—RAILLIET, 1895, p. 831.] [As synonym of *Pediculus suis* in WALCKENAE, 1844, p. 396.]
- 1866: *Hæmatopinus suis* L. GOURBAU, 1866, p. 205. [Misprint.]
- 1874: *Hæmatopinus urius* (NITZSCH, 1818) GIEBEL, 1874, p. 45, pl. 2, fig. 6.—GURLT, 1878, p. 165.—PIAGET, 1880, p. 654, pl. 53, fig. 4.—TASCHENBERG, 1880, p. 103, 105, 106.—ZÜRN, 1882, p. 65.—NEUMANN, 1888, p. 64, figs. 23, 30; 1892, p. 72, 73, fig. 36.—OSBORN, 1891, p. 18, 20, fig. 8; 1892a, p. 338, pl. 1, fig. 5; 1892b, p. 204; 1896, p. 178, 179, fig. 102.—FRANCIS, 1894, p. 452.—LUGGER, 1896, p. 129, fig. 70.—GALLI-VALERIO, 1896, p. 110.—MC CARTHY, 1896, p. 134, fig. 24.—SMITH, 1900, p. 80.—NILES, 1900, p. 66, 67, fig. 26.—LEWIS, 1902, p. 14, fig. 6.—PETERS, 1902, p. 21, fig. 7.—THEOBALD, 1904, p. 22.—CRAIG, 1904, p. 947, fig. 2. [As synonym of *Hæmatopinus suis* in RAILLIET, 1886, p. 586.—BRANDT, 1890, p. 96, fig. 79. As synonym of *Hæmatopinus irritans* in LAW, 1903, p. 13.]
- 1886: *Hæmatopinus suis* (LINNÆUS, 1758) DELAFOND & BOURGUIGNON, 1862, p. 561.—MÉGNIN, 1886, p. 77, 78; 1895, p. 77, 78. [Misprint.]
- 1890: *Hæmatopinus urius* (NITZSCH, 1818) HARZ, 1890, p. 486. [Misprint.]
- 1896: *Hæmatopinus suis*, SCHNEIDEMÜHL, 1896, p. 346. [Misprint.]
- 1896: *Hæmatopinus urius*, SCHNEIDEMÜHL, 1896, p. 346. [Misprint.]
- 1896: *Pedikululus suis*, SCHNEIDEMÜHL, 1896 [as synonym of *Hæmatopinus urius* in SCHNEIDEMÜHL, 1896, p. 346.] [Misprint.]
- 1900: *Hæmatopinus urinus* (NITZSCH, 1818) NILES, 1900, p. 67. [Misprint.]
- 1900: *Hæmatopium urius*, STEVENS, 1900, p. 28. [Misprint.]
- 1903: *Hæmatopinus irritans*, LAW, 1903, p. 13.
- 1904: *Hæmatopinus uris*, CRAIG & BITTING, 1904, p. 169. [Misprint.]
- (?): *Ricinus* (*Hæmatopinus*) *suis*, LEACH in CUVIER [Insectes], pl. 14, fig. 3.

CLASSIFICATION.

Hæmatopinus suis is one of the wingless Arthropoda formerly classed by Osborn (1896) in the family Pediculidæ of the suborder Parasita, under the order Hemiptera of the class Hexapoda, or six-footed insects. On the basis of an embryological study of the Pediculidæ, Kholodkovsky (1903) arrived at the conclusion that they should be classed under a separate order, for which he proposed the name Pseudorhynchota.

Enderlein (1904), in his recent revision of the classification of the Pediculidæ, established the new family Hæmatopinidæ, with a

subfamily *Hæmatopiniæ*, which includes the genus *Hæmatopinus*, with *Pediculus suis* Linn. (= *Hæmatopinus suis* Leach), as type. Enderlein classes the family *Hæmatopiniæ* in the suborder Anoplura Leach (1817) under the order Rhynchota, and makes *Siphunculata* Meinert (1891), *Pseudorhynchota* Kholodkovsky (1903), and *Lipognatha* Börner (1904) synonymous with Anoplura.

GEOGRAPHICAL DISTRIBUTION.

This parasite lives on both domesticated and wild hogs of any age and condition. The numerous references in literature to the hog louse and reports of its occurrence in different countries show that this parasite exists wherever the hog is found. Denny (1842) writes of its common occurrence in Ireland but comparative rarity in England. It is common on hogs everywhere in the United States. Stockmen handling hogs often become temporary hosts of the louse, but it has never been known to remain for any length of time on the human body, and is not known to exist on any animal other than the hog.

Attempts made at this laboratory to propagate *Hæmatopinus suis* on dogs have met with repeated failure.

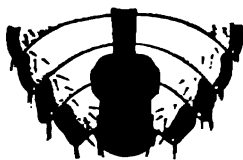


FIG. 3.—Ventral view of last three abdominal segments of male louse. x 12.

DESCRIPTION.

The hog louse is the largest representative of its family, and, as the generic name indicates, is a blood-sucking parasite. The female attains a length of 6 mm. (one-fourth inch). The male is smaller than the female and is readily distinguished by the dark streak along the ventral median line of the last three abdominal segments (fig. 3). The division of the body into head, thorax, and abdomen is distinct.

Head: The head is narrow, elongated, and rounded at the anterior end. The conical, unjointed haustellum, or proboscis, is very prominent, and about the middle of the lateral margins of the head are situated the slender, filiform, five-jointed antennæ, one on each side. Each joint of the antennæ has a dark brownish ring about its middle, the distal joint often being entirely fuscous, and bears on its extremity a tuft of hairs, or bristles. The eyes are flat and of a pale bluish color; they are located posterior and dorsal of the base of the antennæ and are very conspicuous.

Mouth parts: The mouth parts are of particular importance in the present connection as it is due to their action that the irritation and inflammation of the skin, occurring in infested hogs is produced. They are also of interest in view of the possibility that certain diseases, such as hog cholera, may be transmitted by the hog louse.

Burmeister (1847) states that the protrusible haustellum bears a double crown of hooks, with 10 or 12 hooks in each row, and that the sucking tube, or stylet, is formed of an inner and an outer tube, each made up of symmetrical halves. Erichson (1839), Simon (1851), and Landois (1864) each describes mandibles in *Pediculidæ*. Schiodte (1864) states that the "haustellum" described by Burmeister represents the labium, which may be retracted into the head, and that the supposed mandibles seen by Erichson, Simon, and Landois are parts of the labium. Brühl (1871) states that the stylet is formed of dorsal and ventral halves, which are protruded separately and afterwards brought together to form a tube. Gerstfeldt (1853) states that the stylet is formed of two chitinous half cylinders united, and includes two setæ likewise united. Packard (1888) says the *Pediculina* have a

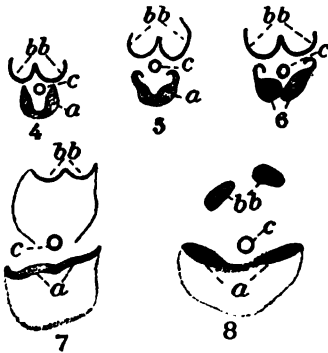


FIG. 4.—Cross section of anterior part of stylet or so-called sucking tube. *a*, ventral part; *bb*, dorsal part; *c*, capillary tube.

FIGS. 5-6.—Cross sections of intermediate portion of the stylet.

FIGS. 7-8.—Cross sections of posterior or basal part of stylet. Fig. 8 shows diverging roots of the stylet. (Magnified 850 times.)



FIG. 9.—Posterior part of capillary tube and ventral part of stylet showing the basal branches or roots.



FIG. 10.—Posterior portion of dorsal part of stylet showing the basal branches or roots.

beak-like sucker which is soft and retractile, with two protrusible chitinous bristles. Kholodkovsky (1903) states that the stylet does not function as a sucking tube, but is merely a piercing organ used to produce a wound and does not convey the blood into the mouth. Enderlein (1904) states that the stylet is formed of two ventral parts (*lobi internus* and *hypopharynx*) united to form a tube and a dorsal part consisting of two chitinous bands.

A cross section of the stylet (figs. 4 to 8) shows that it is formed of three chitinous parts—a ventral half cylinder (*a*), within the concavity of which lies a minute capillary tube (*c*), $2\ \mu$ in diameter, and a dorsal part (*bb*), which is formed of two half cylinders lying side by side and fused together. Each half of the dorsal part is bilobed at its distal extremity (fig. 12).

If a louse is placed on the hand and allowed to thrust its stylet into the skin, a sharp stinging sensation is felt. Soon blood will be seen in a pulsating ventricle in the head of the louse. If the head is now cut off just back of the antennæ, and carefully pulled loose from the hand, the proboscis is seen to be everted, with the hooks on its outer surface



FIG. 11.—Basal branches of stylet and the sheath containing the stylet. (After Burmeister, 1847, fig. 6.)

directed backward, and the stylet, still protruding, is covered with blood stain. This indicates that the stylet is not withdrawn after making a wound, and that blood flows along the parts of the stylet into the mouth cavity, the flow being kept up by the pumping ventricle, which is a modified portion of the esophagus provided with muscle attachments for expanding its walls. The stylet is contained in a movable sheath (fig. 11) in a canal which lies ventral of the esophagus and opens into the mouth cavity. The 12 hooks (fig. 12) on the proboscis are located on its dorsal and lateral surface, none occurring on the ventral side. The hooks are drawn inside the proboscis when it is retracted.

Measurements of the stylet from its base to its extremity give a length of $1\frac{1}{2}$ to $1\frac{1}{2}$ mm.

Figure 11, taken from Burmeister (1847), shows the posterior portion of the stylet with the sheath containing it. The parts *bb* and *c*, described by Burmeister as roots of the inner tube, constitute the origin of the two ventral parts of the stylet (fig. 9, *a*, *c*). The parts *aa*, described as roots of the outer tube of the stylet, form part of the origin of the dorsal part of the stylet (fig. 10). The parts *cc*, described as diverging branches of the sheath containing the stylet, are not only connected with the base of the sheath, but also help to form the origin of the dorsal part of the stylet (fig. 10). Figure 12 is a greatly enlarged dorsal view of the proboscis protruded, showing the 12 hooks everted, also the parts of the stylet. When the stylet is normally protruded its parts are closely approximated and can not be distinguished, except in instances where the dorsal part *bb* is partially retracted and the ventral parts remain protruded.

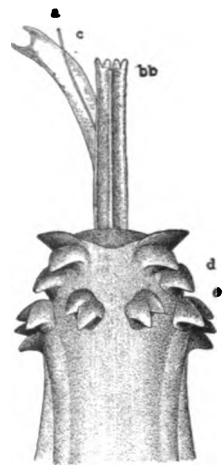


FIG. 12.—Dorsal view of everted proboscis. *a*, ventral part of stylet; *bb*, dorsal part of stylet; *c*, capillary tube of stylet; *d*, hook with single prong; *e*, hook with double prong. The parts of the stylet are separated to show their relations. (Magnified 440 times.)

Thorax: The thorax is broader than long; anterior dorsal margin concave; posterior dorsal margin slightly notched at the median line;

posterior lateral angles acute. On each side, near the anterior lateral margin is a spiracle opening on the dorsal surface. On the ventral surface between the appendages is a chitinous shield. In each anterior lateral angle of this shield or plate is an opening called the osteole, leading from a canal that extends cephalad.

Abdomen: The abdomen is divided into nine segments. The second to the seventh segments inclusive are bordered on each side with a horny excrescence surrounding a light-colored spiracula (fig. 1, c). The first and last segments are without spiracula, and the last segment has on the dorsal surface two dark-colored, chitinous plates joined anteriorly by a narrow strip of chitin. The color of the abdomen varies from ashy blue to nearly white.



FIG. 13.—Claw of *Hamatopinus suis*. a, pad in the end of tibia against which the hair is pressed by the tarsus; b, tarsus; c, tibial tooth.

Legs: The legs, attached on the ventral side of the thorax, are long and thick, pale yellow in color, with banded joints. The tarsus (fig. 13, b) is curved and jointed, enabling the claw to clasp the hair, pressing it against the tibial tooth and retractile disk, or pad, in the end of the tibia (fig. 13). The louse travels sideways and, with the aid of its claws for grasping the hairs, can move quite rapidly.



FIG. 14.—Eggs of *Hamatopinus suis* attached to a hair (magnified eight times). a, natural size of eggs.

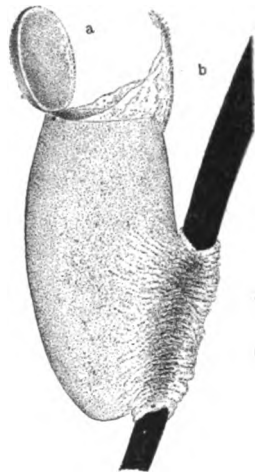


FIG. 15.—Shell of egg from which the young louse has escaped. a, operculum or lid; b, ruptured embryonic membrane. (Magnified 27 times.)

EGG OF THE HOG LOUSE.

When a hog is badly affected with lice hundreds of eggs will be found on the hair back of the ears, along the front of the shoulders, and on the flanks. The freshly deposited egg is bluish white in color, elongated, oval in shape, 1.5 mm. long, and is enlarged at the end bearing the circular operculum, or lid, which is forced open when the

young louse is ready to hatch out. The egg is attached at its smaller end to the base of the hair by a gluey substance that usually completely encircles the hair (fig. 15). The surface of the egg is covered with small hexagonal punctations, which give it a honeycomb appearance. The shell of the egg is perforated by numerous stomata (figs. 16, 17).



FIG. 16.—Outer surface of shell of egg showing the stomata. (Magnified.)

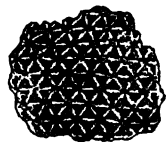


FIG. 17.—Inner surface of shell of egg showing the inner orifices of the stomata. (Magnified.)

Incubation: It is stated in Coburn's (1888) "Swine Husbandry" that the egg will hatch out in about five days after being deposited. Tests conducted at Washington, D. C., however, show that the time of incubation will vary with changes in temperature

and moisture. It was found that eggs freshly deposited and kept in a room of ordinary humidity at a temperature of 85° F. during the month of September hatched out in from fifteen to sixteen days, while the eggs placed in a closed dish containing a receptacle filled with water hatched out in twelve days. Lowering the temperature retards development of the eggs.

INJURIOUS EFFECTS OF THE HOG LOUSE.

It seems necessary to emphasize this part of the subject since usually little attention is given by farmers to this parasite. Every farmer and stock raiser is familiar with the frequency and wide distribution of the hog louse, but they do not always attribute to it any pathologic or economic importance. When a drove of hogs is not thriving properly the more common custom is to pronounce them out of condition, or simply off feed, and a patent stock food or a patent condition powder is administered, with no evident benefit. In such cases, if a careful examination of the animals is made, the cause of the unthrifty condition is often directly traceable to the presence on the skin of large numbers of lice or other external parasites.

When lice increase to large numbers, as they are likely to do if not destroyed, the skin of the animals becomes covered with scales and sores, and in extreme cases swelling and inflammation develop as a result of the parasites piercing the skin with their mouth parts hundreds of times each day in their effort to secure blood for food. The irritation thus produced is a source of constant annoyance and worry to the hogs, evidenced by their restlessness and incessant rubbing and scratching against any convenient object. The ultimate effect of such affliction is seriously to interfere with the growth and fattening of hogs, especially of young pigs.

Lice not only produce a direct injury to hogs by impairment of the skin, but also, by reason of the debilitated condition of the animals

which ensues, indirectly create a greater susceptibility to various diseases. It is stated by Peters (1902), of the Nebraska Experiment Station, that observations in his work show that during epidemics of hog cholera animals affected with lice are most susceptible to the disease, and that the percentage of fatalities is greater than among herds free from lice. So evident is this that the first treatment he recommends for hog cholera is to destroy the lice on the animals and disinfect the pens.

The opinion that the hog louse may carry the infection of hog cholera from sick to healthy animals is not without support among some writers on diseases of hogs. Dodge (1869, pp. 125-217) quotes abstracts from correspondents referring to worms and lice causing hog cholera. No positive evidence or experiments have been brought forward, however, and the possibility of the hog louse conveying diseases is an open question.

The destruction of this parasite is a comparatively easy matter, and practical tests have demonstrated the economic importance of freeing hogs from a pest that deters growth, weakens the general physical condition, and renders the animals an easy prey to contagious maladies.

TREATMENT FOR THE HOG LOUSE.

PREVENTIVE MEASURES.

Any treatment to prove effective against lice on hogs must include preventive measures as well as destructive remedies. The sleeping quarters of lousy hogs become infested with lice, which crawl off the hogs and secrete themselves in the crevices of the building and in the bedding, while the eggs on the hair that the hogs shed and rub off will hatch out young lice. These parasites in the building immediately reinfest animals from which the lice have been removed by treatment. The selling and slaughtering of the majority of hogs at a comparatively early age, and the consequent destruction of the lice on them in the scalding vat, is naturally a great check to the increase in the number of the parasites. As a usual thing, however, an entire herd of hogs is not sold at one time, and the few remaining animals will serve as hosts for the lice in the building until a new drove of hogs is placed in the same pens, when the lice at once begin to multiply rapidly on their new hosts. A thorough treatment, therefore, includes the destruction of the lice in the buildings and pens in addition to treatment of the animals themselves. If the pens where lousy hogs have been kept are left vacant for a period of two weeks all lice will have perished, and any new animals introduced will be in no danger of infection.

For disinfection of buildings Peters (1902) gives preference to a 3 per cent solution of any of the coal-tar preparations, to be applied with a broom or spray pump.

Niles (1900) recommends a 2 per cent solution of carbolic acid, solutions of benzine and kerosene (said not to be so effective as carbolic acid), and air-slaked lime having a little carbolic acid added and dusted over the floors.

Probably the most convenient method of combating lice and mites in buildings is the common custom of applying whitewash made by slaking lime with water (1½ pounds to 1 gallon of water). Popular usage has made this a standard remedy, for it has been found to be effective. Crude carbolic acid added to the whitewash (1 pint of the acid to 4 gallons of whitewash) is said to increase its effectiveness.

In treating hogs infected with lice special attention should be given to those parts of the body where the lice congregate in greatest numbers. They are found principally inside, behind, and in front of the ears, on the breasts, and back of the fore legs. Even with the most thorough treatment, however, some of the lice are apt to escape, and these, if not destroyed, soon increase in numbers. The eggs are not all destroyed by any single treatment. These facts make it necessary to repeat any treatment used in order entirely to eradicate these pests from a badly infested herd. When strange hogs are added to a herd they should always be examined for parasites in order that any infested ones may not cause the spread of lice throughout the entire herd.

TREATMENT OF THE HOGS.

Many different preparations have been used to destroy lice on hogs. Probably the oldest method is the use of washes or liquid insecticides. It is frequently stated that a dust bath for hogs is destructive to lice, but T. J. Brewster (1894), of Kansas, declares that the lousiest hogs he ever saw were confined in extremely dusty pens; he recommends kerosene as an effective remedy.

The agricultural experiment stations have carried on numerous experiments in the treatment of the hog louse, and a brief review of the work is here given.

Gillette (1889) successfully used kerosene emulsion, which was sprayed over pigs by means of a force pump and spray nozzle. Thirty-seven hogs, weighing from 125 to 250 pounds, were treated with 6 gallons of emulsion, the cost of which (exclusive of labor) was but 13 cents. The animals were crowded into a close pen and thoroughly sprayed. The cheapness of this remedy allows it to be used freely and often, as is necessary with the usual treatments.

Lewis (1902) constructed a dipping vat and used proprietary dips. He states that his experiments proved the remedies to be useless in the weak solutions recommended by the manufacturers. Nothing less than a 2 per cent solution could be relied on to kill the lice.

A. E. Verrill (1870) reports as the best and simplest remedy a solu-

tion of sulphuret of potassium in water—from 2 to 4 ounces to 1 gallon of water. Apply the solution with a brush or spray.

Lugger (1896) recommends pyrethrum mixed with kerosene emulsion.

Tracy (1899) used successfully kerosene and water in a spraying pump (see p. 21) with an attachment for mixing the oil and water in the proportion of 5 parts of water to 1 of oil. He recommends spraying in the evening, in order that the oil may evaporate during the night, thus avoiding the danger of blistering the skin by action of the sun's heat on the oily skin.

The various stock journals of this country contain frequent notes from rural correspondents reporting success in the use of pure kerosene, applied to the animals by means of a spraying machine or with a brush or broom.

E. H. Kern (1904), a Kansas farmer, writes that he used pure kerosene oil applied with a knapsack sprayer (fig. 26). He states that, contrary to the expectations of his neighbors, the hair did not come off, neither did the skin blister, but on the morning following the application "thousands of dead lice were found among the loose scales of dirt and mange on the backs of the hogs." The animals immediately improved in looks and condition.

Craig & Bitting (1904) recommend pure kerosene oil as the cheapest remedy for lice on hogs. A sufficient amount of water is placed in the dipping vat and the oil then added to a depth of 1 inch. The hogs, when driven through the liquid, emerge with a thin coating of oil over the entire body.

It must be stated, however, that the application of pure kerosene to the skin of hogs has been known to produce blisters and cause the hair to fall out. The writer has observed these results follow such heroic treatment. When pure kerosene is applied, the caution to use it in the evening in order to avoid the effect of the sun's heat on the skin freshly wet with kerosene must be strictly observed, and care be taken not to apply the oil too freely.

The statement has been made (Knob, 1903) that kerosene used on pregnant sows will produce abortion, but the frequent use of kerosene on pregnant sows without evil results ensuing indicates that such accidents are unusual.

Oliver (1896) recommends 1 part of kerosene mixed with 2 parts of linseed or cotton-seed oil, applied once a week till the lice are all destroyed.

A decoction of stavesacre seed (*Delphinium staphysagria*), using 2 ounces of seed to 1 quart of water, is much used in England to kill lice. Vinegar added to the liquid is said to destroy the eggs of lice.

A decoction of equal parts of hellebore, sabadilla, and stavesacre has been recommended as effective against lice.

A herd of lousy hogs in the vicinity of Kensington, Md., was treated in separate lots with kerosene emulsion, several proprietary preparations, and an emulsion of Texas oil. These remedies were all tested at this laboratory by plunging lice into the various solutions and laying them aside to dry. Every preparation in dilute solution killed the lice in a few seconds, excepting the Texas oil, which was effective only in concentrated solution and acted more slowly.

The hogs were sprayed twice, two weeks intervening between the two treatments. Kerosene in a 10 per cent emulsion proved successful. Creolin in a 3 per cent solution also destroyed the lice. The Texas oil in a 10 per cent emulsion was found to be absolutely useless. The exact results of the tests with proprietary preparations could not be determined, for the pigs treated with them escaped from their pen after the first treatment and a few lice were found on some of the animals.

Later experiments with Texas oil in the crude state have demonstrated its value as a dip for hogs affected with lice and the itch mite (*Sarcoptes scabiei*). Fifty-two gallons of oil were placed in a tank with 60 gallons of water and the pigs dipped once. A few days after dipping the lice were found to have disappeared, and the scab mites, with which the animals were severely affected, were also destroyed.

The foregoing account of results of experiments with different remedies used against the hog louse shows that the following are successful, cheap, easily prepared, and readily applied: Kerosene emulsion, kerosene and water, kerosene (pure, but to be used with caution), Beaumont oil, and benzine emulsion (not much used). None of the arsenical or poisonous insecticides is mentioned, for, when nonpoisonous remedies are thoroughly efficient and readily obtained there is no necessity of running the risks attendant on the use of these poisons.

The lime-and-sulphur dip recommended as a cure for scabies in cattle and hogs was tried as a remedy for lice on hogs but has not as yet been sufficiently tested for a statement of results at this time.

FORMULAS OF OIL EMULSIONS.

1. Kerosene emulsion is prepared according to the proportions in the following formulas:

- (a) Hard soap, $\frac{1}{2}$ pound (one-half bar common soap).
Kerosene, 2 gallons.
Water, 1 gallon.

Boil the water and soap until the latter is dissolved, remove from the fire, then add the kerosene and churn or agitate vigorously till an emulsion is formed. This emulsion, if thoroughly mixed, will form a gelatinous mass on cooling; it keeps indefinitely and may be used at any time by diluting with warm water to 20 gallons. If used after cooling, the mixture should be heated again (great care must be exercised in heating a second time because of the inflammable kerosene present, and for

safety the mixture should be heated out of doors) and then thoroughly mixed a second time.

(b) Soft soap, 1 quart.

Hard soap, $\frac{1}{2}$ pound.

Kerosene, 1 pint.

Water, 2 quarts.

Mix as in preceding formula and dilute with 1 gallon of warm water. Reheat as in formula (a)

(c) Sour milk, 4 gallons.

Kerosene, 2 gallons.

Mix the milk and kerosene and dilute with warm water to 20 gallons.

This formula has the advantage over other methods of making kerosene emulsion, as it avoids the necessity of making a soap mixture, the milk acting as an emulsifier.

(d) Hard soap, $\frac{1}{2}$ pound.

Pyrethrum, $3\frac{1}{2}$ pounds.

Kerosene, 2 gallons.

Water, 1 gallon.

Boil the water and soap until the latter is dissolved. Extract the pyrethrum with the kerosene by stirring the pyrethrum and kerosene together and allowing the mixture to stand for twenty-four hours, then pour off the liquid. The kerosene extract is then mixed with the soap solution as in formula (a). For use dilute with warm water to 20 gallons. Reheat as in formula (a).

The pyrethrum is said to add to the effectiveness of the emulsion.

The kerosene emulsions when prepared should not have oil drops rising to the surface. If drops of oil are seen it is proof that the emulsion has not been sufficiently churned or agitated to emulsify the mixture.

Goff (1891) describes and figures a spraying pump for mixing kerosene and water, which mixture is said to be more penetrative than an emulsion. This pump is fitted with a foot-valve admitting oil and water through separate orifices and a graduated screw regulating the proportionate amount of each fluid admitted. The packing and pistons should be made of leather and the valve seats of brass, on account of the destructive action of the liquid on fittings made of other materials.

2. Benzine emulsion:

Soft soap, 4 parts.

Water, 10 to 15 parts.

Benzine, 1 part.

Boil the water and soap until the latter is dissolved, remove from the fire, then add the benzine and agitate till an emulsion is formed.

MANGE, OR SCABIES, OF HOGS.

CAUSE OF MANGE.

Mange in hogs, which is a disease of the skin caused by parasitic mites, is of two kinds. The demodecic form is produced by a mite named *Demodex folliculorum* var. *suis* (= *D. phylloides* Csokor) (figs. 21, 22). The sarcoptic form, which is better known and considered to be more common than demodecic mange, is caused by a mite known as *Sarcoptes scabiei* var. *suis* (figs. 18, 19). These two parasites of mange in hogs are designated as "variety *suis*" in order to distinguish them from parasites of the same species which cause mange in the dog, the cat, the sheep, and some other animals. Many writers consider them distinct species, and a third mite, *Sarcoptes parvulus* Can., has been described from the hog.

SARCOPTIC MANGE.

Neumann (1888) states that Viborg described this disease in the year 1805, but that Spinola first found the sarcopt causing it on wild hogs in the year 1846.

Gerlach (1857) mentions its frequent occurrence on wild hogs near Berlin and on hogs in Holland. Müller (1864) and Kocourek (1865) both found the sarcopt on hogs in China. This parasite has been observed in England, France, Ireland, Denmark, Canada, Japan, and frequently in the United States.

The disease is described by the majority of writers on hog diseases, and numerous references to it are found in the veterinary journals and in periodicals devoted to the hog industry.

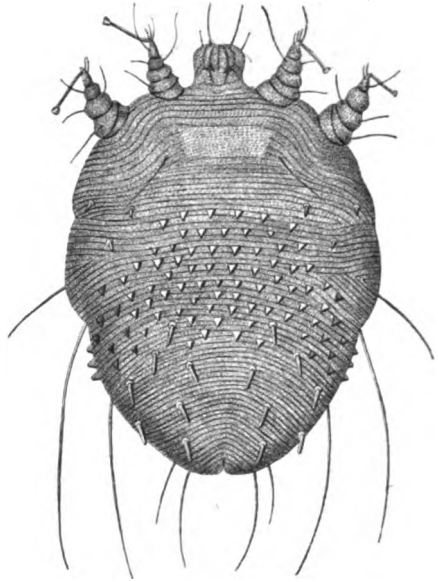


FIG. 18.—Dorsal view of female mite (*Sarcoptes scabiei* var. *suis*) causing sarcoptic mange. (After Gerlach 1857.) $\times 150$.

DESCRIPTION.

This parasite is the largest variety of its species and can readily be seen with the aid of a pocket lens. It is small, white, globular in shape, with the body transversely striated. In front is a prominent mobile rostrum. On the dorsal surface of the body are numerous three-cornered scales, also 6 thoracic and 14 abdominal spines.

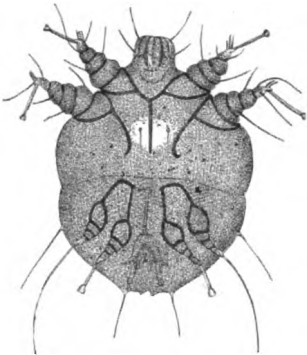


FIG. 19.—Dorsal view of male mite (*Sarcoptes scabiei* var. *suis*) of sarcoptic mange. (After Gerlach, 1857.) $\times 150$.

The first and second pair of legs in the female bear a pedicellate sucker. The third and fourth pair end in a long spine. The first, second, and fourth pair of legs in the male bear a pedicellate sucker, while the third pair end in a long spine.

The female is nearly one-half millimeter long and about one-third millimeter broad. The male is a little smaller than the female. The egg is 0.17 mm. long and 0.12 mm. broad.

REPRODUCTION.

The eggs (fig. 20) are deposited by the female and hatch, according to different authorities, in three to eight days, under favorable conditions.

It has been estimated by Gerlach that a male and a female sarcoptid will, after a period of three months, have a progeny of 1,500,000 descendants.

SYMPTOMS.

The skin is first inflamed and irritated about the eyes and ears; the pruritis gradually spreads over the withers, flanks, and inner surface of the thighs, later invading the entire surface of the body. The skin becomes wrinkled, is covered with crusts that take on a bluish gray luster, and the bristles either fall out or become matted with the crusts that are continually forming and dropping off. Beneath the crusts the skin is raw and cracked, the excoriation finally becoming so severe that bleeding occurs when the crusts are pulled off.



FIG. 20.—Egg of *Sarcoptes scabiei* var. *suis*. (After Gerlach, 1857.) $\times 150$.

Conclusive diagnosis of sarcoptic or demodectic mange is obtained by finding the parasites. It is necessary to pull off the crusts and scrape the skin to the quick, and then examine the scrapings with a hand lens.

CONTAGION.

The disease is distributed only through contagion, either by diseased animals or by means of the buildings and pens where diseased hogs have been kept. It gradually spreads throughout a herd. An infested sow will transfer the disease in a severe form to her young before they are three weeks old.

Spinola (1863) states that scabies of the pig is not transferable to other animals. It has, however, been transmitted to the dog, and is said to be transmissible to the horse. Numerous instances are recorded of man contracting the disease through contact with mangy hogs.

THE INJURIOUS EFFECTS OF MANGE.

Because of its destructiveness to the skin and the restlessness produced in the animals infested, sarcoptic mange is a most serious disease that increases in severity, and not only prevents proper growth and fattening of hogs, but will finally cause death to young pigs. It is, too, a more common disease than is generally believed.

TREATMENT.

The instructions usually given for treating scabies, or mange, of hogs direct that the animals must be thoroughly cleaned by scrubbing them with soap and water or some strong alkali solution before a remedy is applied. Such care and detail are possible where only a few hogs are to be treated, but when herds numbering from 50 to 500 are to be treated such time-consuming and expensive operations are out of the question. Dipping the animals is the only practical method of applying remedies to large herds. Mange is at best a hard disease to combat, especially in hogs, because of their unclean habits and usually filthy quarters. When mange is discovered, the hogs should be shut away from mud wallows a day or so before treatment in order that the dirt and crusts may become rubbed off the skin.

It is not a difficult thing to control a hog in a properly constructed dipping vat, and an animal may be kept in the dip as long as desirable while the liquid is being rubbed into the skin with a brush or broom. Care must be taken to wet the inside of the ears thoroughly by rubbing them with the hands. If the hogs are simply driven through the dip without any scrubbing it will require a long time to eradicate the disease. After the hogs have been dipped they should be kept away from mud wallows and dusty pens for a day, in order that the dip may not be absorbed by dust and mud coming in contact with the wet skin. A time should be chosen for dipping when there has been no recent rain to make it possible for hogs to become covered with mud crusts. Never dip in cold weather. If only a few hogs in a herd show symptoms of scabies it is not sufficient to dip only those few that are badly infested, for other animals in the herd are sure to harbor some of the parasites, which will continue to spread the infection. A single dipping is not sufficient for a cure, for some of the parasites will escape destruction by the first dipping and more young mites will hatch from recently deposited eggs. A second dipping, therefore, should follow six days after the first treatment. The incubation period of the eggs under favorable conditions is stated to

be from three to five days. Perseverance is the only way to effect a permanent cure. The improved condition of scabby hogs, even on the day following a successful treatment, will be evident from their unusual quietness and better humor.

In addition to treating hogs for mange it is necessary either to remove the animals to new quarters for a period of four weeks, after which time the danger of reinfection in the old quarters is past, or to clean and wash the pens and buildings. (See p. 17 for washes for buildings.)

REMEDIES.

There are numerous mixtures and compounds that kill the scab mites, but the item of expense and the facility of preparation and application restrict a choice of remedies. Liquid remedies are the only practical ones to be used on a large scale; if ointments are used it is necessary to scrub the animals thoroughly before applying them.

Ointments.

- (1) Helmerich's pomade (=sublimed sulphur 2 parts, potassium carbonate 1 part, lard 8 parts).
- (2) Creosote 1 part, lard 25 parts.
- (3) Sulphur 10 parts, lard 30 parts.
- (4) Turpentine 8 parts, flowers of sulphur 1 part.

Liquid preparations.

- (1) Lime-and-sulphur dip (=unslaked lime 10 pounds, flowers of sulphur 24 pounds, water 100 gallons).

Slake the lime with sufficient water to make a thin paste and stir in the sulphur. Boil this mixture with 25 or 30 gallons of water for two hours. Pour the liquid into a vessel and allow the sediment to settle. The liquid is then drawn off into the vat (carefully avoid disturbing the sediment) and warm water added to make 100 gallons. The proportions in this mixture must be exact. This preparation is used while warm.

Mr. J. J. Rosa, of Milford, Del., in a letter dated December 3, 1904, states that he used the above dip on 40 head of hogs affected with mange and reports a perfect cure after a second treatment.

- (2) Potassium pentasulphide, 1 kilogram (2.2 pounds) dissolved in 30 liters (31.5 quarts) of water.

Scholl (1904) in a recent treatment of 160 hogs badly infested with mange washed them with soap and water, then applied the above solution. From the first day of treatment, it is reported, the irritation diminished; the skin lesions healed, and the animals rapidly put on flesh. A second treatment was given in two weeks as a precautionary measure.

- (3) One part of creosote mixed with 30 parts of oil [linseed] is a remedy said to be much used in Germany.

- (4) Beaumont, or Texas, oil. (See p. 20 for method of application.)

Some hogs, belonging to Mr. Vern Godden, of Greenwood, Nebr., were recently observed by the writer to be in poor condition and covered with grayish scales. Examination gave a diagnosis of sarcoptic infection in a severe form. The animals, without any previous washing or preparation, were dipped in the Beaumont oil. They were driven into the dip and scrubbed with an old broom. Special care was taken to rub the inside of the ears with the hands, since the skin on those parts was raw and cracked, and harbored scores of the parasites. The day following this treatment the animals were more quiet, and ate their food better; this improvement was particularly noticeable in the young pigs.

On October 6, 1904, one month after treatment, Mr. Godden wrote: "As to the condition of the hogs, they are much better since the treatment; some seem to be entirely cured of that scaly look. I would recommend the Texas oil as a good thing for scabby hogs." Failure to dip a second time according to instructions, accounts for the lack of complete success in this experiment.



FIG. 22.—Ventral view of female *Demodex folliculorum* var. *suis*. (After Csokor, 1879.). (Magnified 240 times.)

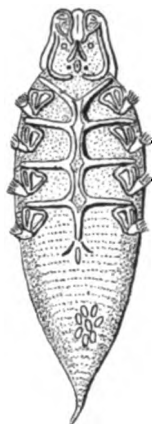


FIG. 21.—Ventral view of male *Demodex folliculorum* var. *suis*. (After Csokor, 1879.). $\times 240$.

DEMODECIC MANGE.

Csokor (1879) first found the *Démodex* in pigs, and, on account of its resemblance in shape to a laurel leaf, named it *Demodex phylloides* (figs. 21, 22). The parasite, however, is sometimes grouped with the other varieties of the genus *Demodex* found on other animals into a single species *folliculorum*, and designated as *Demodex folliculorum* var. *suis*. *D. folliculorum* is said to be of rare occurrence, but this statement is doubtless incorrect and results from a failure to recognize the parasite. Government inspectors have frequently withheld hogs from the market because of a peculiar appearance of the skin which was shown to be caused by *Demodex*. Leather manufacturers state that a large percentage of beef hides received are partially ruined by the pitted condition of the skin, a condition which is produced by this parasite found on the cattle. It is generally held that *D. folliculorum* does not produce any pathologic symptoms nor perceptibly interfere with the growth of the

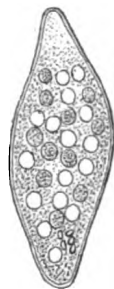


FIG. 23.—Egg of *Demodex folliculorum* var. *suis*. (After Csokor, 1879.). $\times 240$.

animals, hence it seems to be of direct economic importance to leather manufacturers only.

The female (fig. 22) is 0.25 mm. long, elongate, with eight pairs of three-jointed legs, each provided with two claws. In front is a short median rostrum. The abdomen is tapering, transversely striate above and below, and rounded at the extremity. The vulva is situated in the anterior portion of the ventral surface of the abdomen, in front of the anus. The egg (fig. 23) is fusiform and hatches a larval hexapod, which moults three times before arriving at maturity.

The male (fig. 21) is distinguished from the female by the presence of a genital armature in front of the anus, and it is a little smaller in size.

Demodex folliculorum bores into the hair follicles and sebaceous glands, causing pustules that enlarge, rupture, and leave sores and ulcers on the skin. This disease spreads from the snout, over the neck, the under part of the chest and abdomen, and over the flanks and inner part of the legs. Its deep location in the skin protects the parasite from ordinary treatment.

APPLICATION OF REMEDIES.

In applying liquid insecticides to hogs, spraying and dipping are the two methods generally used. Where there are only a few animals, the remedy can be easily applied with a brush or broom, but in a large herd a more rapid method of application is desirable.

DIPPING.

Dipping the hogs is obviously the most thorough method, but more expensive on account of the labor and material necessary to construct a dipping vat, unless a large number are to be treated. Peters (1902) describes and gives the following instructions for constructing a dipping vat costing about \$25:

- 12 feet 4-by-6-inch white pine or tank lumber.
- 40 feet 4-by-4-inch.
- 16 feet 2-by-6-inch.
- 16 feet 2-by-4-inch.
- 24 feet 4-by-4-inch.
- 24 feet 3-by-4-inch.

For the approaches and dripping platform:

- 10 feet 2-by-12-inch tank lumber.
- 100 feet 4-by-4-inch yellow pine.
- 60 feet 2-by-6-inch.
- 114 feet 2-by-4-inch.
- 162 feet fencing.
- 17 pounds 20-penny nails.
- 7 pounds 10-penny nails.
- 10 square feet of zinc.
- 4 "T" hinges, 8 inches.

The accompanying illustration (fig. 24) gives plans for constructing the vat. The zinc is used to cover the incline leading to the vat, in order that the smooth surface afforded will prevent the animals from halting after once starting for the plunge. The zinc covering is, of course, not a necessity, but it is very convenient. The vat is placed in an excavation in the ground, and should project about 6 inches above the surface of the ground, in order to prevent dirt and trash from falling into the dip.

Most farmers and stock raisers usually have a quantity of waste or unused lumber lying about that may be utilized in constructing a dipping plant, thus diminishing the actual cost of construction. A canvas curtain hung at the entrance to the slide will facilitate driving the hogs.

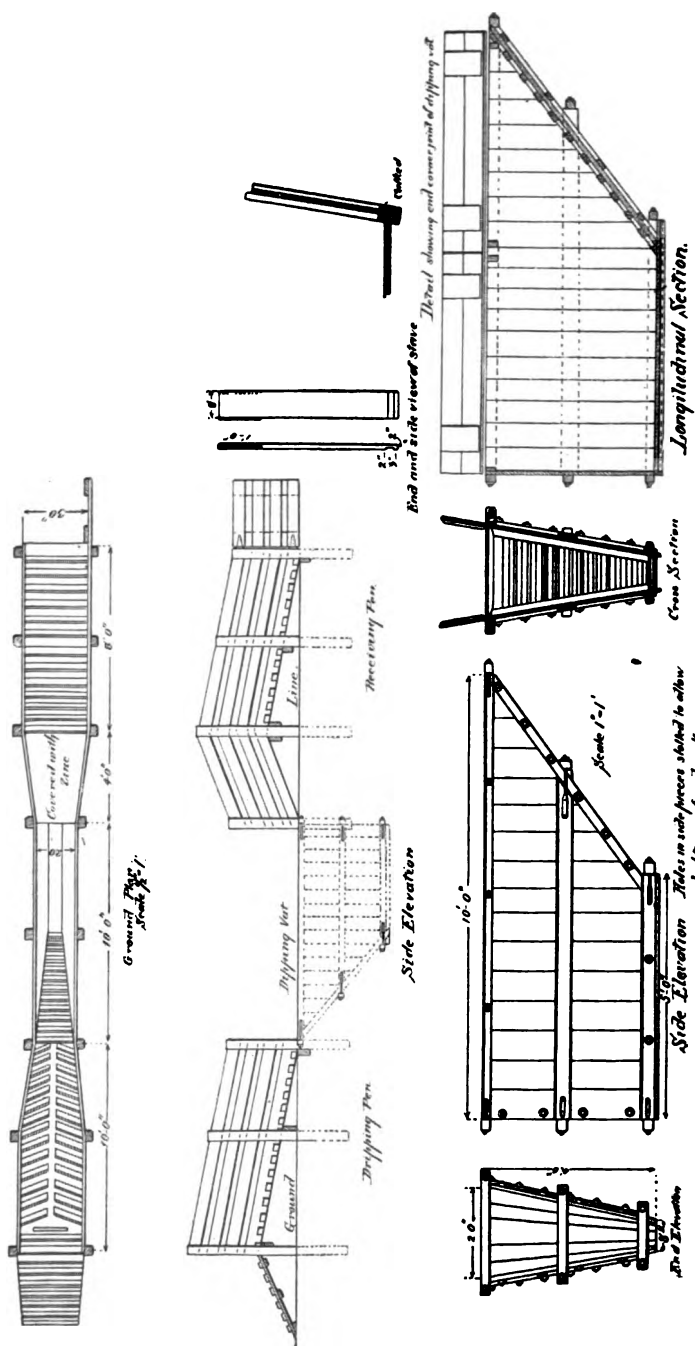


FIG. 24.—Plans for dipping tank.

The dripping platform is constructed of tongued-and-grooved lumber, slants toward the vat, and is bordered with narrow strips along the sides, in order to direct the liquid back into the vat. The platform is cleated as shown in the cut. The dipping vat should be placed in close proximity to the pens, and where a stationary chute is not built, movable panels of fence will make transferring the hogs an easy matter.

Lewis (1902), of the Oklahoma Experiment Station, constructed a galvanized-iron 22-gage vat, in which one-half inch gas pipe was used as a framework. The entire cost of such a vat, with inclined entrance and exit, is between \$25 and \$30.

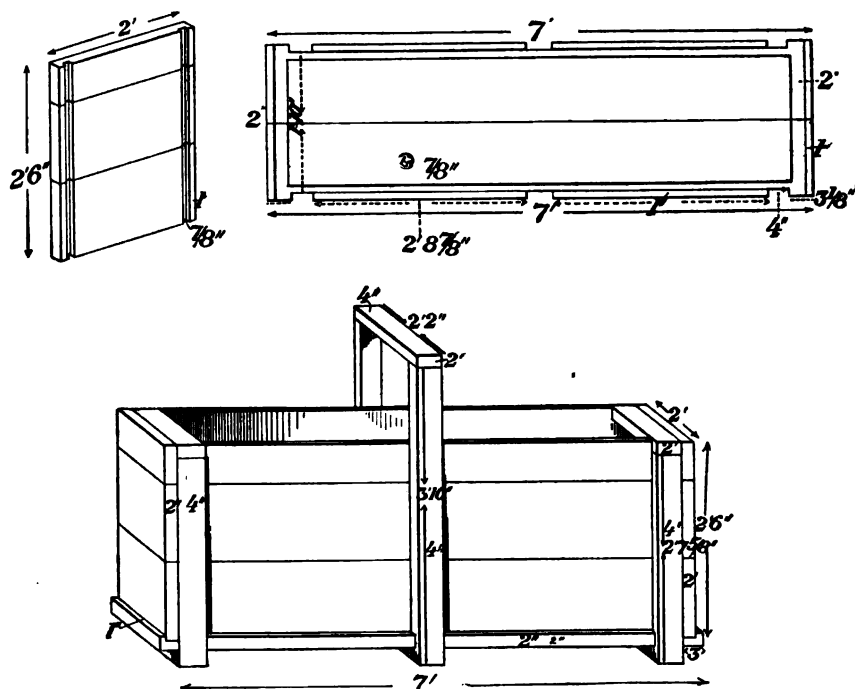


FIG. 25.—Plans for dipping tank.

There are several makes of dipping tanks offered on the market, any one of which will give satisfactory results. Galvanized and cast iron tanks of various sizes cost from \$10 to \$20.

A simply constructed portable dipping vat (fig. 25), used by the writer for some experiments in treating lousy and scabby hogs, is very serviceable for dipping moderate-sized herds of hogs and is also inexpensive. No dripping platform was used, consequently considerable liquid was wasted. Where there are more than 40 or 50 hogs to be dipped it is necessary to provide a dipping platform or else replenish the liquid.

The following materials are required to construct this vat:

- Two 1 by 12 inch by 14 foot hard pine.
- One 2 by 12 inch by 24 foot hard pine.
- Three 2 by 4 inch by 12 foot hard pine.
- One 1 by 6 inch by 15 foot hard pine.
- One 2 by 6 inch by 12 foot hard pine.
- Two pounds 20-penny nails.
- Two pounds 10-penny nails.

The 2-inch planks are used for the bottom and ends of the tank, the 1-inch boards for the sides, and the 2-by-4 sticks for braces. When matched lumber is not available, the boards are joined at the edges as perfectly as possible, the cracks smeared with pitch, and calked. The boards for the sides of the tank are cut 6 feet $6\frac{1}{2}$ inches long, clamped together (after the edges have been smeared with pitch and dowel pins adjusted), and the proper braces (2 feet $7\frac{1}{2}$ inches long) nailed on each end one-half inch from the end, with the braces projecting below the lower edge of the side,

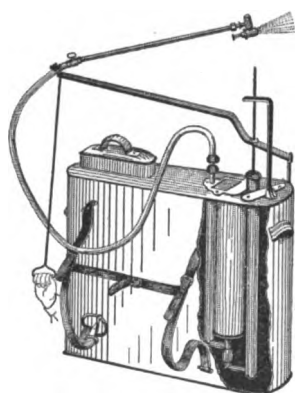


FIG. 26.—Simple spraying apparatus.

as shown in the cut. The middle brace is now nailed on in the position relative to the notch in the bottom made to receive it. The end boards are similarly joined and held together by temporary braces tacked on the outer side.

The two boards for the bottom are joined, and the braces, cut just long enough to extend between the inner margins of the notches made to receive the side braces, are nailed in place. The sides are then set in the grooves in the bottom (using pitch in the joint), forced firmly into position, and the side braces nailed to the bottom and to the ends of the braces on the bottom. The ends are next firmly fitted in the grooves in the bottom, nailed from the under side with 20-penny nails, and then nailed to the sides and side braces. The braces across the top are then nailed on.

Three pieces of 2 by 6 plank $2\frac{1}{2}$ feet long, held together by cleats nailed across them, serve as a ladder for the pigs to crawl out on. The upper end is movable so that it may be raised from position in order to keep the pigs in the dip as long as desired. The lower end of the ladder is supported 6 inches above the floor of the tank and is anchored down with a cord tied to a staple driven into the bottom of the tank. The upper end rests on the brace across the top and is held from slipping down by means of a cleat nailed on the under side. The inside measurements of the vat when completed are 6 feet 6 inches long, 1 foot 8 inches wide, 2 feet 5 inches deep, and holds $6\frac{1}{2}$ gallons of fluid to an inch of depth. Twenty inches of fluid is sufficient to cover a

300-pound hog. When using this vat it is of course necessary to increase the height of the sides by a temporary construction and to construct a chute leading to the vat. The vat should be sunk into the ground a depth of 2 feet, thus saving the trouble of having to force the pigs up an inclined plane. It is most convenient to set the vat in front of a door to a hog house, sink it into the ground till the top is level with or a little below the floor of the house, and then build a barricade from the door along the sides of the vat.

SPRAYING.

When the necessary apparatus is provided, dipping the hogs is the most convenient and rapid method of applying insecticides. Experi-

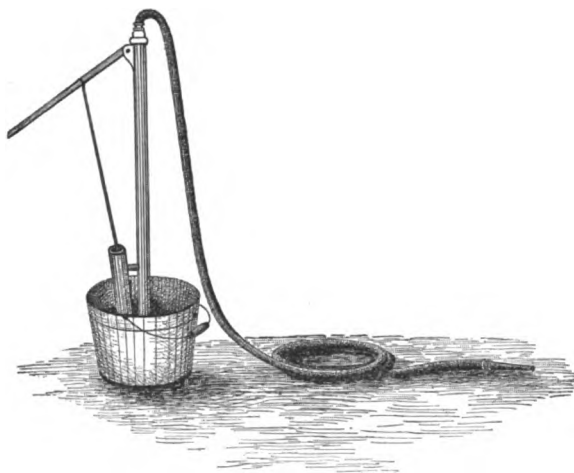


FIG. 27.—Simple spraying apparatus.

ments, however, have proved that spraying liquids over animals is equally effective if thoroughly performed. A force pump is fitted with a hose of sufficient length to permit freedom of motion to the operator. A spray nozzle is attached to the end of the hose, or, as has



FIG. 28.—Simple spraying apparatus.

been done in the absence of a suitable nozzle, the end of the hose is simply compressed between the thumb and forefinger, making a fan-like spray that can be readily directed in any quarter. Any outfit for spraying trees is likely to contain nozzles that can be adapted to spraying liquids over animals. For those who do not possess a spraying

apparatus, and do not care to purchase the more expensive outfits, one of the cheaper pumps put out by firms handling such goods will serve the purpose very well.

The illustrations of spraying outfits given (figs. 26-28) represent the character of some of the less expensive ones offered for sale. There should be considerable force to the jet of fluid, and the spray must not be too finely divided, otherwise the liquid will not penetrate between the hair and thoroughly wet the skin, as it must do to be effective.

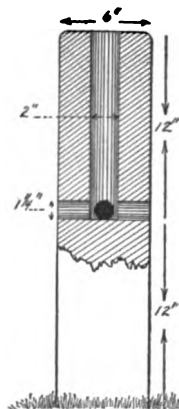


FIG. 29.—Sectional view of post with holes bored from top and sides.

A method of applying kerosene to hogs that is as simple as it is ingenious was employed by Moore (1891) and Riedel (1891). A 6 by 6 inch oak post is set firmly in the ground (fig. 29). A 2-inch hole is bored 12 inches into the top of the post. A 1½-inch hole is bored from each side of the post to open into the bottom of the larger hole. Soft-pine plugs are driven into the small holes and burlap or old cloth is wrapped around the post, covering the pine plugs, and bound down with wire. The hole in the top of the post is then filled with kerosene. In a short time the rags become saturated with the kerosene percolating through the pine plugs. Two quarts of oil daily are required the first three or four days

and afterwards 1 quart a week. Riedel remarks that "every hog wanted to be first at the post," and that the lice in the herd soon disappeared. A platform should be built around the post in order that the hogs will not dig a mud wallow about its base.

Byrn (1890) devised a "wholesale method of ridding a herd of lice" by digging a basin, or wallow, in the yard, pouring in water and throwing in a small quantity of kerosene. He states that the pigs frequented this place and the lice soon disappeared.

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(Continued on page 3 of cover.)

U. S. DEPARTMENT OF AGRICULTURE,

BUREAU OF ANIMAL INDUSTRY.—Bulletin No. 70.

D. E. SALMON, D. V. M., Chief of Bureau.

THE MILK SUPPLY
OF
TWENTY-NINE SOUTHERN CITIES.

BY

C. F. DOANE, M. S.,

Special Agent of Dairy Division, Bureau of Animal Industry.



WASHINGTON:

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1905.

LETTER OF TRANSMITTAL

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF ANIMAL INDUSTRY,
Washington, D. C., February 17, 1905.

SIR: I have the honor to transmit the accompanying report upon "The Milk Supply of Twenty-nine Southern Cities." This report was compiled by Prof. C. F. Doane, M. S., professor of dairy husbandry and bacteriology in the Maryland Agricultural College, while acting as special agent for the Bureau of Animal Industry, under the direction of Maj. Henry E. Alvord, late chief of the Dairy Division.

It was found in the preparation of Bulletin No. 46, Bureau of Animal Industry, "The Milk Supply of 200 Cities and Towns," that the Southern cities had some peculiar problems and conditions. This led to the investigation as presented in this report, which adds much valuable information to the present knowledge of the subject of milk supply in American cities. I therefore recommend that this manuscript be published as Bulletin No. 70 of the series of this Bureau.

Respectfully,

D. E. SALMON,
Chief of Bureau.

Hon. JAMES WILSON,
Secretary.

Dy-60.

CONTENTS.

	Page.
The dairy situation in the South.....	9
Consumption of milk in southern cities.....	11
How the milk is handled.....	13
Milk and dairy inspection.....	14
Peculiar coast conditions.....	16
Suggestions for improvement.....	17
Evil of keeping cows in city.....	17
Evil of delivering warm milk.....	18
Pasteurization.....	19
Details of the milk supply of the cities.....	20

STATISTICS OF MILK SUP

State and city or town.	Population in 1900.	Daily consumption in addition to family cows.	Number of cows kept in city.	Retail price per quart.	Retail price per gallon.	Price per gallon paid to producers.
Alabama:		<i>Gallons.</i>		<i>Cents.</i>	<i>Cents.</i>	<i>Cents.</i>
Birmingham	38,415	800	500	6-10	20-25	20
Mobile	38,469	400		8-10	25-35	20-22½
Montgomery	30,946	600	350	6½	15-20	
Florida:						
Jacksonville	28,429	500		8-10	25-30	
Pensacola	17,747	400	Few.	10	35	
Georgia:						
Atlanta	82,872	5,000		7-10	20	15-20
Augusta	39,441	600	500	6-10	20-30	
Macon	23,273	800		6-8	20-25	
Savannah	54,244			7-8½	25	
Louisiana:						
Baton Rouge	11,269	150		6½-8½	25	
New Orleans	287,104	12,970	a 6,723	7½-10	20-25	10-16
Mississippi:						
Meridian	14,050	250		7½	25	
Natchez	12,200	300		8-10	25	
Vicksburg	14,884	350		8-10	25-30	
North Carolina:						
Greensboro	10,085	200	325	6-8	17-20	
Raleigh	13,643	150	300	7-8	20-25	
Wilmington	20,976	200	400	10	25	
South Carolina:						
Charleston	55,807	300	750	8-10	24	16
Columbia	21,108	250		7-10	24	
Spartanburg	11,385			6	20	
Tennessee:						
Chattanooga	30,154	2,000	Many.	6-7½	16-20	15
Knoxville	32,637	1,000		6-8	20-25	
Memphis	102,320	8,500		6½-10	11-20	11-15
Virginia:						
Danville	16,520	350		8½-10	20-24	
Lynchburg	18,691	400	200	6-8	16½-25	
Norfolk	46,624	2,000		8-10	20-25	20
Portsmouth	17,427					
Richmond	85,050	5,000	500	6-8	25	15-17
Newport News	19,635					

^a Not including 18 herds just outside the parish of New Orleans.

PLY OF SOUTHERN CITIES.

Cream.		Ice cream per gallon.	Butter- milk per gallon.	Amount of milk sold in bottles.	Amount of milk cooled before selling.	Longest distance shipped.	Page on which state- ment is found.
Per cent fat.	Price per quart.						
	<i>Cents.</i>		<i>Cents.</i>			<i>Miles.</i>	
25	40	\$1.50	10	Nearly all.....	All.....	25	33
	40-50	1.50-2.00	20-25	do.....	Nearly all.....		34
25	40	1.25-1.50	10-15	Small part.....	Small part.....		32
		1.50		Part.....	Part.....		31
25	40-50	2.00+	25		Very little.....		32
25	40	1.20-3.20	12½	Nearly all.....	Large part.....	35	28
25	40	1.50	12-15	do.....	None.....		30
25	40	1.25-2.00	10-15	Part.....	Nearly all.....		30
				Some.....	Some.....		29
	40			None.....	Almost none.....		38
	30-40	1.50-2.00		Small part.....	Small part.....	40	36
	30-40	1.50		Part.....	Small part.....		35
	40	1.25-3.00			Almost none.....		35
	30-40						34
	25	1.00	10	Nearly all.....	Nearly all.....		25
20-30	25-40	1.00-2.00	10	Small part.....	Some.....		25
35	60	1.50	20	All.....	Part.....		24
18	25	1.00-2.00	20	Part.....	Small part.....		26
30	50	1.60	10		Part.....		27
		1.50-2.50					27
20	25	1.25		Part.....		60	40
	30	1.00-1.25		Small part.....	Part.....	20	40
30	25	80-1.00	10	Part.....	do.....		39
20	40		10-20	Half.....	do.....		23
		1.00		Nearly all.....	None.....		23
		1.00-4.00	20	Half.....	Some.....		21
25	30	1.25			Cooled at depot...	15	20
					Part.....		22

THE MILK SUPPLY OF SOUTHERN CITIES.

By C. F. DOANE, M. S.,

Special Agent of the Dairy Division, Bureau of Animal Industry.

THE DAIRY SITUATION IN THE SOUTH.

The observations reported herein were made in order to obtain information concerning various conditions affecting the milk supply of representative Southern cities.

The lack of knowledge concerning the milk supply of Southern cities, compared with cities of the same size and importance in Northern States, is very likely due to two causes. In the first place, the dairy industry in the South has not in any of its branches attained the importance that it has in the North and West, and therefore has not invited the same amount of attention that it has in the North. Again, a large amount of the information on dairy subjects in the North has been disseminated by the agricultural press, and this has naturally aroused interest in the industry; but the South does not have many agricultural papers, and is therefore deprived to a large extent of this excellent method of promoting dairy knowledge.

As might be expected, there is a wide difference in the way dairying is conducted in the South as compared with the North. The climate and the differing systems of agriculture are very likely the cause of this. The Southern farmer cultivates large areas with much hired help. The Northern farmer cultivates small farms and, with the help of his family, does the greater part of the manual labor. These small farms have naturally led to intensive farming in the North, and in consequence the live-stock industry, including dairying, has been pushed to a prominent place. The character of the soil of the North, the short growing season, and the small farms have together served to make stock raising one of the most profitable of occupations, and it has become one of the best-known branches of agriculture in that part of the country. In the South, however, dairying is not especially regarded as a branch of agriculture. It is seldom carried on there in connection with other farming operations. In fact, in very few cases is any attempt made to raise all or even a small part of the feed con-

sumed by the cows. This condition has led to the keeping of cows in or near the cities on very small areas of land; and even where the herds are kept a few miles out from the cities, where an abundance of cheap land is available, the same general plan is followed of keeping cows in a small area, where no pasture is provided and feeding is exclusively on commercial foodstuffs. This practice is not calculated to result in the greatest profits. In fact, profitable dairying in any section depends upon the production on the farm of the feed consumed by the dairy herd. The Southern dairyman, as a rule, buys all his feed. This consists mostly of cotton-seed products, which are of doubtful value when fed in great quantities to the exclusion of other food products. Cotton-seed products are, of course, cheaper in the South than in any other portion of the country; and, in a few localities, where abnormally low prices have prevailed for the hulls, they evidently make as cheap a ration as could be purchased in any locality, not excluding the Middle West, where forage crops sell at a low figure. Many dairymen, however, give other feeds than cotton-seed hulls, and their cost becomes very high, for the South does not raise all of the forage needed, and consequently Northern feeds must be obtained. It is difficult to understand why the dairymen do not raise their feed. The system of dairying that is carried on in the North, if adopted, could not fail to be more profitable to the producer and more healthful for the consumer. The amount of forage that can be raised on an acre of land in most of the Southern States is beyond the conception of the Northern farmer. The growing season is almost twice as long as in the North, and, moreover, the soil under proper condition of tillage, where fertilizer is applied, responds wonderfully. The land itself is cheap and usually easily tilled, and forage crops of almost all kinds can be produced cheaper than in the North. Notwithstanding these facts the dairymen of the South pay to the Northern producer a profit plus the cost of shipping such bulky freight a long distance. In other words, the Southern dairyman is wasting his fertilizer and the natural advantages of soil and climate. Moreover, the cattle would be healthier if they could have pasture or plenty of green feed, they would produce more milk, and the entire industry would be placed on a more satisfactory basis for producer and consumer.

CONSUMPTION OF MILK IN SOUTHERN CITIES.

Comparatively little milk is consumed in most Southern cities. The amount per capita in Richmond is not quite one-half pint, which is about as high an average as in any Southern city, while at Pensacola it is as low as one-fifth pint, and in Mobile less than one-tenth pint. These are the only cities where anything like approximate figures of the amount of milk consumed could be secured. In Richmond a very

careful and businesslike dairyman had collected the figures of the total milk sold. In Mobile and Pensacola the amount of the business was so small that it was not difficult to secure satisfactory figures. Richmond did not have enough family cows to influence the average figures greatly, while in Pensacola no family cows were kept, and in Mobile not a large number.

What is true of the consumption of milk is even more true of the consumption of cream. One of the most notable features in the sale of milk products is the exceedingly light sale of cream. It can be said that practically no cream is sold in the South for use as it is used in other parts of the country. To buy cream for use in coffee or with fruit is unheard of. The greater part of the cream sold carries a high percentage of fat and is used for whipping. The remainder is used for making ice cream.

To account for the small quantities of milk and the smaller quantities of cream consumed is a most difficult undertaking. It may be that the people do not use these products because they are unable to secure them, which would seem to be the case in some of the cities considered. On the other hand, they refrain from buying in some instances when the dairymen have enough and to spare, this being evidently the case in Charleston and a few smaller places. This lack of desire to buy may be because the people do not like milk to the extent that they do in the North, or are suspicious of the kind of milk sold. Most of the physicians, especially the younger men, recognize that the milk offered for sale is not of good quality and, as a consequence, few invalids receive milk, and a surprisingly large proportion of the infants are fed on condensed milk. So universal is the practice of feeding condensed milk that many physicians expressed surprise when told that fresh milk was much preferred for infant food in other parts of the country, and that the use of condensed milk for this purpose was very exceptional and was usually severely criticised.

Were the people able to get a high grade of milk in quantities desired throughout the year it is very likely that the consumption would gradually increase. This would be especially true at Pensacola, where the supply is short of the demand. It is true that in most cities dairymen find little trouble in disposing of all the milk produced during the greater part of the year. For at least half of the year there appears to be a distinct shortage in the supply. On the other hand, in the spring there is a surplus. Milk producers in the South, as elsewhere, seem generally to think that the spring of the year is the only time when a cow should come fresh. As a consequence the most milk is produced during the spring and summer, when the best customers are away from the cities, whereas when the greatest quantity

of milk could be sold the cows are not producing sufficient to supply the demand. There can be no doubt that these periods of short supply decrease the amount of milk consumed, even in periods of plenty, for the people get into the habit of doing without milk. For instance, at Spartanburg, a city of over 11,000 inhabitants, there was but one dairy and that of only 25 cows, and the owner had a hard time disposing of all his product, although it is evident that he was selling good milk. In fact, this city once had three dairies, but two were closed out because they could not get enough business to pay. There are cities where all the milk is produced that can be disposed of, as in Charleston, where dairymen, who are doing a good business and handling a good grade of milk, stated that no more milk could be sold in the city than is now being consumed. This is also true of many of the smaller cities.

It is a matter of some speculation as to the future course of the dairy industry in Southern cities. Some of the leading citizens always said on inquiry that there was a good opening for a first-class dairy. While there may be some question as to the reason for the small consumption of milk, there can be none concerning the even lighter use of cream. The light cream trade is indicated by the fact that housekeepers can not secure as much as they would use. Moreover, the shortage has tended to very high prices, comparatively, as 40 cents a quart retail appears to be the usual price. In fact, cream is a decided luxury. A considerable quantity of cream is shipped south from Tennessee and the mountain district of North Carolina. Little cream is used in making ice cream, and that, with few exceptions, is shipped from considerable distances.

Ice cream and buttermilk are two dairy products in which a very heavy business is done in the South, except in the Mississippi Valley States. This is very likely due to climatic conditions, as hot weather, of course, is always conducive to a brisk trade with ice cream, and the human system craves the acid of the buttermilk under the same conditions. The ice cream, as a rule, is not of the best quality, because the necessary cream, as heretofore stated, can not be obtained for making it, and to use imported cream would be too costly. Most of the ice cream is made from whole milk, but condensed milk and cream are not uncommon in its manufacture. In some cities enormous quantities are made from whole milk and sell at \$1.50 to \$2 per gallon, whereas ice cream makers in the North make a good profit in wholesale cream with 10 to 15 per cent of fat at \$1 per gallon. In a number of cities where there is a particularly small milk trade imported cream or condensed milk is used exclusively in the manufacture of ice cream. With these facts and comparative figures before us, it is easy to realize the demand for this article in the South.

It is likely that as much so-called buttermilk is consumed in the South as whole sweet milk. A person unacquainted with the true condition could hardly realize the great demand for this product. The writer sat in the office of a city dairy in one of the smaller cities of North Carolina and watched a steady stream of customers filing in, and nine out of every ten came with the purpose of getting buttermilk, though the proprietor said that it had been understood that no buttermilk would be available for a number of days. The price charged for this buttermilk is seldom below 12 cents a gallon retail, and it is usually 20 cents a gallon. It may well be asked how so much buttermilk is to be secured when so little butter is made. The answer is, that practically all of this buttermilk is simply skim-milk allowed to sour and then churned for a few minutes. Sometimes customers demand a few granules of butter as an evidence of good faith, and this is met by churning a very small portion of cream in a glass jar, allowing the butter granules to come very fine, and putting this butter into the churned milk. The deception seems to answer all requirements. Buttermilk from churned cream is simply the sour milk from which the fat has been removed. The fact that it was allowed to sour before removing the fat influences the character or the quality of the buttermilk not a bit. As buttermilk is such a desirable article of food in the South, the practice of churning sour skim-milk should be encouraged rather than discouraged. There may be some doubt as to the propriety of calling the product buttermilk, but to all intents and purposes it is buttermilk.

It has already been noted that the heavy buttermilk trade and ice cream trade in a measure decreases in the cities in the Mississippi Valley. There seems to be no explanation of this, as the climate and other conditions are the same, so far as observed. Tastes and practices are sometimes sectional, but this is hardly a satisfactory explanation of the existing condition.

HOW THE MILK IS HANDLED.

Very little milk is shipped for any distance to Southern cities, as has been mentioned. The greater part of it is produced in the immediate neighborhoods of the cities—so close that the railroads are seldom used in transporting it—and much of it is produced by herds kept within the limits of the cities. The fact that no milk is shipped for a distance does away with the very important problem of the handling of the milk by railways, but, as we shall see, it has led unnecessarily to a considerable evil. Milk is retailed usually directly from the farm. This may or may not be an advantage. Milk that is delivered by the producer ought to reach the consumer sooner after

milking than if it had to go through other hands; but the city dairies which buy from the producer and sell to the consumer, when rightly conducted, put the milk through a process that often improves its keeping qualities. As there are few city dairies, the selling of milk to small consumers by grocery stores is very limited, and the cities are to be congratulated on escaping this evil, which is the greatest curse of the milk business in large cities of other sections.

The general plan of the milk business is about as follows: The cows are milked very early in the morning and afternoon, so as to get the morning milk delivered in time for breakfast. The milk may or may not be strained. In some instances it is run over a cooler of the truncated cone style. From observation, this cooling was so inefficient as to be useless in most instances. This warm milk is then bottled or put in cans having no device for protecting the afternoon delivery from the fierce heat, and is thus carried to the consumer. The consumer has very little knowledge of how to care for the milk. Usually this matter is left to a servant, and no attempt is made to keep it in a cool place. Most Southern households are liberal users of ice. The kitchen refrigerator is common, but it is not utilized for keeping the milk. Here is where the city dairy or depot might be an influence for good, as the milk would be reduced to an ice temperature and would have its period of usefulness lengthened by several hours. It would thus reach the consumer in better condition, even if it were several hours older, than that delivered by the producer.

A number of cities are discussing the idea of pasteurizing the milk supply, and two that were visited had plants for this purpose.

Practically all of the milk sold to the city consumers is delivered from wagons. Very little hand trade or push-cart trade is done, Charleston being the exception to this general statement. The wagons are, of course, of almost every description and condition, although there is a particular style that is in general use. Some milk for hotel use was brought from a distance in heavy farm carts, and small producers generally used a covered spring wagon. Considering the fact that there is no strenuous competition and no regulations, the wagons, on the whole, were quite good and kept in good condition.

MILK AND DAIRY INSPECTION.

A number of cities that were visited regulated the milk supply to some extent. The regulations were copied largely from those of Northern cities. This inspection service has not been in force more than a few years in any of these cities, but the idea is being adopted by others very rapidly. The regulations affecting milk in some of these cities are very simple, and it appears that their simplicity gives

strength. The principal points of any good milk regulations can be covered in a few words: The milk must have a certain content of butter fat; no foreign substances may be added to the milk; stables and yards must be in a prescribed condition; cattle shall be in a certain condition of health—even tuberculin tested. These are given in the order of their importance as generally considered by city health authorities. Certain details are sometimes added for the purpose of facilitating the enforcement of these points or to make it more difficult for dealers to evade the law; but where this is carried too far more harm than good is done, and there is always a tendency in such instances to get so many regulations that none of them will be fully enforced.

As a rule, the ordinances relating to the milk supply of the cities visited are few and simple, but comprehensive. Moreover, it is very doubtful if there is any other section of the country where regulations in regard to milk are more consistently and rigidly enforced. This is done in the face of the fact that it is doubtful if a very few years ago one-fourth of the milk consumed in these cities was an honest product in every particular. The records of analysis made by city health officials before the adoption of milk regulations show a pretty bad state of affairs. Skimming, watering, and preserving were generally practiced. This information was gained by periodical visits to premises and by talks to sellers who gave all the evidence required of the efficiency of the inspection service, and in no instance was the word of officers in charge accepted as to what had been accomplished. Retailers, without exception, bitterly condemned the activity of the officials.

How the inspection has been made so effective may need explanation. As has been said, the regulations are simple and the work is new. As a rule, young men from agricultural or medical schools, with the new ideas in regard to the qualities of good milk, have been placed in charge of the work. A sufficient number of assistants is provided, and samples are taken often from every wagon. The percentage of fat required in the milk varies with different cities from 3 to 3.5 per cent. In one case only was there any statement by inspectors that this was higher than the producers could meet. This was at Jacksonville, Fla. As a rule, milk produced in the South is comparatively rich in fat. The inspectors at Memphis, Tenn., where samples were taken periodically at the barns, were of the opinion that a standard above 4 per cent could be enforced and no herd disqualified. The results obtained from some of these samples showed a very high percentage of butter fat for an entire herd. These high tests are very likely due to the fact that the Jersey blood predominates to a large extent in the South. At Jacksonville, however,

there is very little Jersey blood, the native stock making up most of the dairy herds. How the milk from these cows tests is not known to the writer, but it appeared from a few observations as if the low fat test of the milk sold in that city was very likely due to skimming or the addition of water.

It is doubtful if any appreciable quantity of milk that is sold in cities having inspection contains preservatives; on the other hand, it is doubtful if any city without inspection receives any great quantity of milk free from preservatives. The climate and the methods of handling milk give the producer an excuse, in his opinion, for using preservatives, and large quantities are undoubtedly used.

The inspection of stables is usually very strict, and it is very likely that the condition of the country-kept dairies around many of the cities is generally better than that of any city north of Washington, D. C. The frequent visits of the inspectors have had this effect. Stables whitewashed, well ventilated, free from dust and cobwebs, and with floors thoroughly cleaned are always to be found in the dairies supplying some cities.

A considerable number of Southern cities require an annual tuberculin test, but every city enforcing this requirement reports an unusually low percentage of reacting, or infected, cows. For instance, at Birmingham, Ala., and Norfolk, Va., less than 1 per cent was reported to have reacted. Birmingham is in an exceedingly healthy location, and the almost constant outdoor exercise of cattle in the Southern climate would tend toward a low percentage of tuberculous cattle; but Norfolk can not advance this argument. A great part of the Norfolk dairy cows are shipped from Baltimore. The dairy herds of Maryland have a high percentage of tuberculosis, and it is entirely improbable that none but healthy cows were shipped to Norfolk. In fact, the reports from all the cities showed such a low percentage as to bring the efficiency of the testing seriously into question by all scientists acquainted with the subject.

PECULIAR COAST CONDITIONS.

The seacoast cities present peculiarities and conditions not found in the dairy industry in any other part of the country. A number of the largest cities of the South are situated on the seacoast, and any problem peculiar to them is interesting. Most of these cities are built upon what was once the beach sand of the receding ocean. In many places these sandy coast plains stretch back for many miles from the ocean. They are covered by pine forests, but it seems that in many instances the forest growth has added very little to the fertility of the sandy soil; especially does this seem to be the case where the sand reaches to any depth. In such land, which makes up a large

area, the addition of manure or fertilizer is only of temporary benefit, as it very quickly leaches out of the surface layer and away from the roots of the growing plants. The rains are excessive at certain seasons of the year and aid in this leaching process. Occasionally a subsoil of clay is found at a few inches to 2 feet below the surface. Even with the clay subsoil it seems impossible to grow crops that are grown farther inland, but this is a condition that may be due, to some extent, to the lack of knowledge on the part of the farmers.

This naturally creates a problem of obtaining a cheap and satisfactory food supply for producing good milk. Under present conditions a large part of the rough feed is hay, shipped from the North and sold at a very high price.

Another problem is the effect of the hot, humid climate on the productive capacity of the cows. It was asserted by dairymen who were apparently capable of judging that cows brought from the interior to the coast shrank very materially in their milk yield after the first year. In a couple of instances the writer went over the situation very carefully with the owners and secured minute information in regard to feed and care. It certainly appeared that, aside from the fact that the cows seldom received green feed, they were in condition to give a maximum quantity of milk. With the combination of low yield of milk and difficulty in growing paying crops, these cities are certainly in a very poor way ever to secure an abundant supply of satisfactory milk.

SUGGESTIONS FOR IMPROVEMENT.

The necessities of the several cities are enumerated later on in the detailed discussion of their milk supply; but a somewhat more particular consideration is necessary regarding some features. The following two evils stand out as being characteristic of the dairy industry of the South:

EVIL OF KEEPING COWS IN THE CITY.

The first and greatest evil is that of the keeping of cows in small inclosures inside the city limits. As has been stated, a great proportion of all the milk sold is from dairies thus located; and, even where the herd is outside the city, it is kept under the same condition of close quarters and with no green feed. It is a little difficult to understand why these conditions are tolerated so generally as they are. In many places the city health boards are waging a vigorous war against the practice, but, as was stated, the interest of the health boards in the dairy business is new, while the keeping of cows

in the city is long established. The manner of keeping the cows has such a firm hold on the people that years will be required to do away with it, though it is a menace to public health. Cows are naturally filthy, especially in wet weather, and are clean only so long as they are helped to be so. It is next to impossible to produce good, clean milk with herds kept under these conditions. By all means, all herds should be driven outside the limits of the cities and the family cow should receive the most careful attention. This would be no hardship to the dairymen, and would be a benefit to the city and the consumer. It is a mistaken idea on the part of dairymen that leads them to keep herds in the city. The greatest profit in dairying is on a farm where feed can be raised and the manure saved.

EVIL OF DELIVERING WARM MILK.

The other great evil of the business in the South is the delivery of warm milk. At the present time this is the fault of the consumers, who are the losers by the practice. The reasoning which leads to this practice is simple: Cows' milk spoils with age; when it is fresh it is warm; therefore if it is ~~delivered warm~~ it is fresh, otherwise it is not. The result is that during the summer very little milk reaches consumers that is fit for use or in condition to keep sweet for more than a few hours, even under the best treatment. This milk is three hours old on the average when it reaches the consumer. During the greater part or all of this time it has been kept at body temperature or has cooled very slowly from contact with air at a temperature little lower than that of the milk. Milk has to be drawn and handled under very cleanly conditions in order to keep it sweet for more than five hours at body temperature. Much of it will spoil in four hours. This being true, probably three-fourths of the time during which the milk would remain sweet has been lost because it was not cooled when it was drawn.

The afternoon's milking and delivery has particularly bad treatment. The cows are milked from 12 to 2 o'clock. The warm milk is bottled, and at about 3 o'clock the wagon starts on the delivery. The bottles are often exposed to a temperature of 100° F. Frequently the milk is directly in the sun. Is it any wonder that much of this milk is sour by the time it reaches the consumer?

Milk is constantly shipped to New York from a distance of more than 200 miles under conditions of temperature often as severe as that of the Southern States, and it reaches the consumer twenty-four hours old and in better condition than the warm milk delivered in Southern cities, which are within 3 miles of the place in which it is produced and within three hours from the time it is drawn from the cow.

Under these conditions of nearness of producer and consumer there

are possibilities of an ideal milk supply. This would not call for any great amount of labor on the part of the producer. In cities where milk regulations have already done so much, the one thing necessary is to cool the milk. Some dairymen already make some pretense at cooling the milk, but in very few cases is it of any benefit. The cooler used is one that requires ice to have any effect, and ice is not used. No attempt is made to replenish the water, which soon becomes warm. The type of cooler needed, and the only type which will do good service, is similar to a coil of pipe. The cold water flows constantly through the coil from the bottom to the top, and the warm milk runs in a thin film over the surface from the top to the bottom. The milk is in this way cooled to very near the temperature of the fresh water. With this type of cooler the milk can easily be cooled to 70° F. in any locality—often colder, depending on the temperature of the water. While milk at body temperature will hardly keep five hours, milk cooled immediately to 70° F. will keep more than twelve hours; at 60° F. it will keep more than two days, and at 50° F. a considerably longer time. It should be possible where ice is used for domestic purposes to deliver milk that would keep for table use until the next morning. This would do away with the early milking, which is very objectionable, and it would make one delivery a day sufficient. This warm-milk evil is far worse than any of the conditions opposed by city health boards. It would be very easy to remedy this evil, and with the present knowledge of handling milk there is no possible excuse for its continuance.

PASTEURIZATION.

As has been stated, there is a tendency of public opinion to favor pasteurization of milk. Pasteurization as applied to milk has been advocated for about ten years, but, for reasons concerning the machinery needed, it is only within the last five years that it has been applied to a general milk supply. It can serve two purposes only in any locality: One purpose is to kill the disease germs present, and the other is to add to the length of time that the milk will keep. Of the disease germs, the only one at all prevalent in any milk supply is the one causing tuberculosis. In exceptional cases other disease germs may be present, and a few outbreaks of typhoid fever have been traced to the milk consumed.

As regards the increased keeping qualities of the milk, there is ground for possible difference of opinion. Pasteurization, of course, kills a large percentage of the germs present, and, when rightly done, without doubt adds to the length of time the milk will be palatable. The word palatable should be emphasized. Two points need to be brought out here: Pasteurization, when applied to the purpose of keeping the milk sweet for any length of time, simply serves, as a

rule, to cover up dirty treatment and poor care of the milk. Furthermore, pasteurization, to be effective, must be carefully done, giving every attention to the detail of heating to the right temperature and cooling quickly to a low temperature. When this is not done it is worse than useless. Now, on these grounds, when applied to milk shipped from long distances and produced on farms far beyond the eye of the dairy inspector there is a chance that pasteurization may serve a useful purpose. But with the dairies furnishing the milk so close to the city that the inspector may make occasional visits, and with all details so thoroughly under the care of the health board, there is no need for pasteurization, and the cities that undertake it will give it up in disgust in a very few years.

DETAILS OF THE MILK SUPPLY OF THE CITIES.

In the following pages the cities are treated individually regarding details of the milk supply. The population given is that of the last census. The estimated amount of milk sold is based usually on the number of cows, though, in a few instances, the applications for license to sell milk were used as a basis. The estimate of the number of family cows was either secured from responsible citizens or based on tax returns. The figures are given for what they are worth, for either source mentioned was far from correct. In only one city, Charleston, had an actual count of cows been made. It would have been interesting to give the amount of milk consumed per capita, but owing to the very large and indefinite proportion of family cows such figures would be valueless.

Richmond, Va.

Population, 85,050. Amount of milk sold daily, exclusive of that produced by family cows, 5,000 gallons. Perhaps 500 family cows are kept in the city.

The following are the prices for dairy products sold in the city: Milk retailed to consumers, 6 to 8 cents per quart, the greater part selling for 7 cents per quart; milk in gallon lots to hotels, restaurants, etc., 25 cents per gallon; price paid for milk to producers by dealers, 15 cents per gallon in summer, 17 cents per gallon in winter; cream containing 25 per cent of fat, 30 cents per quart retail, ice cream made from 20 per cent cream, \$1.25 per gallon.

Richmond is the only city south of the Potomac with a milk supply handled in any manner similar to that of the larger Northern cities. It is the only one of the Southern cities which has a large city milk depot, handling the greater part of the milk consumed by the inhabitants. The city has two such establishments owned by private individuals. One of these depots drives twenty-five wagons and does a business comparing favorably in extent with the dairies of Northern cities. In the general plan of handling the milk and in modern improvements these two dairies are equal or superior to the greater number of similar establishments in the North. The milk is handled much the same, though the locality influences this to some extent. No milk is shipped a greater distance than 15 miles, the greater part being produced by herds kept within

driving distance of the city.^a The farmers milk very early in the morning and afternoon and deliver the milk to the depots as soon as possible without cooling. Here it is immediately run over coolers, the temperature being reduced to below 59° F. The morning's milk is delivered in the afternoon and the evening's milk in the morning, the milk being at the time of delivery almost 8 hours old in one case and 15 hours old in the other. This is a much shorter period from producer to consumer than will be found in most Northern cities, and is due to the fact that the producers live within delivering distance of the city. As the milk is comparatively well handled after reaching the city dairy, the consumers should receive a very good article.

In regard to the rest of the milk, delivered direct from the farms to the consumers, not so much can be said. The recently established milk inspection insures good quality in composition, but it is very likely, as regards the sanitary conditions of the stables and handling of the milk before it reaches the consumer, that there is much to be desired, as is the case in every city. It is likely that, as the inspection becomes more thorough, the general condition of all stables will be much improved. Perhaps the greatest abuse is seen in the delivery of warm milk. This is not so much the fault of the producer as of the consumer, but, wherever the fault lies, the health department should correct it. In Richmond all the milk handled by the city depots is practically ice cold, and this should have led to the practice of cooling all milk.

The ordinance providing for a dairy inspection requires that a permit be taken out by retailers, such permit to be valid for such period only as the premises are maintained in fit sanitary condition. The ordinance requires 3 per cent of fat in the milk, and milk cans containing skim milk are to be plainly labeled. Three inspectors are kept employed. The analyses made of the milk by the inspectors before and after the ordinance went into effect show that regulation was badly needed, as the milk had evidently been of very poor quality.

The dairy business in this city has gone through a gradual development. The city milk depots are not old concerns. Prior to their establishment the milk was sold direct from the dairy farms; in fact, it has not been many years since nearly every family in the city that was able to do so kept its own cow. The cream trade in the city is comparatively new, five years ago there being no cream whatever sold.

As has been pointed out, no warm milk should be allowed to be delivered in the city. Producers should be required to use milk coolers. It might be well for all the milk to be bottled, at least when customers demand it. At the present time very little, if any, bottled milk is sold, the can with a faucet at the bottom being used in nearly all cases. Dairy cows should not be allowed to be kept in the city. The groceries should not be allowed to handle milk. Richmond is the only Southern city that has this sort of milk trade, and it is so great a source of evil that it should not be tolerated.

Norfolk and Portsmouth, Va.

Population: Norfolk, 46,624; Portsmouth, 17,427. Amount of milk sold daily, exclusive of that produced by family cows, 2,000 gallons. Number of family cows, not estimated.

The following are the prices for dairy products: Milk retailed to consumers, 8 to 10 cents per quart; milk in gallon lots to hotels, restaurants, etc., 20 to 25 cents per gallon; price paid for milk to producers by dealers,^b 20 cents per gallon; ice cream of doubtful quality, from \$1 to \$4 per gallon; buttermilk retails

^a Some cream is shipped from Washington, and some from Baltimore.

^b Only a very little milk is thus handled, as the greater part is sold directly from the producing dairies.

to consumers at 5 cents per quart. There is no trade in cream except for a small quantity that is shipped in for ice cream making.

Norfolk is the only city in the South where the dairymen have a valid excuse for not feeding and keeping cows as they are kept in the better dairy districts. This city is situated in one of the great trucking sections of the United States, and the land that could otherwise be devoted to raising feed for dairy cows is held at \$300 to \$1,000 an acre. This is too valuable land to be used for raising feed for dairy cows. The only alternatives are to ship milk from a distance, which, with the present state of dairy knowledge in the South, would be impracticable, or to confine the herds on comparatively small areas and feed almost wholly on imported foods. The latter course has been adopted, though in a few instances a small area of the valuable trucking land is utilized for growing silage corn, which furnishes a portion of the feed.

The milk when it reaches the consumer is almost fresh, as the milking is done at an early enough hour in the morning to allow the fresh milk to be delivered in time for breakfast. A number of the better dairymen cool the milk before delivering, though much of the milk is delivered warm. About half of the retail milk is bottled, and the health office is very strict in enforcing the regulation against refilling bottles on the route. Before the ordinance in regard to dairy inspection and the use of preservatives went into effect Norfolk received much of its milk from Baltimore, but at the present time the milk is all produced within 5 miles of the city. An indefinite number of cows were kept for private use in the city limits. But the entire milk product is much below the actual requirements of the city and the shortage is made up by a heavy sale of condensed milk.

The milk sold in Norfolk is of very good quality, comparatively, owing to two causes—one being the fact of a comprehensive inspection ordinance well administered, and the other the influence of a couple of very fine dairies that have set a rather high standard, which must be met partially by all other dairymen doing a competitive business. These two dairies are the equal in all respects to many of the so-called sanitary dairies of the North.

The ordinance providing for the inspection of milk and dairies of Norfolk requires the milk to contain 3 per cent of fat and that certain conditions be observed in regard to cleanliness around the stables and milk houses, the inspector having the power to revoke licenses where these conditions are not complied with. The ordinance further provides that all cows furnishing milk in the city are to be tuberculin tested. Under this order over 1,100 cows have been tested. There is a chance for question as to the thoroughness of this test, since less than 30 of the 1,100 cows responded to the test. Portsmouth differs from Norfolk in having no inspection law, but as in many instances the same dairies supply milk to the two cities it is thought advisable to consider the two together.

Newport News, Va.

No regular study was made of the milk situation in Newport News, but inquiries were made, and, as this city lies across the James River from Norfolk and Portsmouth, it is interesting to make some comparisons. The milk retailed in Newport News does not have an enviable reputation for quality. This is due to two causes. The city has no milk inspection, and the dairymen do about as they see fit. And, again, no dairyman has as yet undertaken to supply the city with good milk, as has been the case in Norfolk. The people have made an effort to secure such a dairy, which would show that the present condition is not wholly the consumers' fault. Prices and other conditions are about the same as in Norfolk. It is obvious that the city needs an ordinance regulating the production and sale of milk, as no city is likely to secure good milk without such an ordinance.

Lynchburg, Va.

Population, 18,891. Amount of milk sold daily in city, exclusive of that produced by family cows, 400 gallons. Number of family cows kept in city estimated at 200.

The following are the prices for dairy products: Milk, retail to consumers, 6 to 8 cents per quart; milk in gallon lots to hotels, restaurants, etc., 16½ to 25 cents per gallon; ice cream of very poor quality, \$1 per gallon. There is no cream trade in the city.

The amount of milk given as consumed daily was approximated by getting the number of cows that supply the city with milk and estimating the yield per cow. About 250 cows are kept in dairies for the city trade. Of these, 150 produce the milk for the strictly retail trade and the others supply hotels and restaurants. Some milk was, of course, sold to neighboring families from most of the family cows. A liberal estimate for the milk actually consumed for domestic purposes would be about 400 gallons per day. This is an exceedingly small amount per capita compared with Northern cities. Why such a small amount of milk should be consumed is difficult to determine when we consider the fact that the country around Lynchburg is much better adapted to dairy farming than to any other agricultural pursuit, being very rough and difficult of cultivation. This small consumption may be due either to the fact that no more milk can be obtained or to the small demand. In some of the Southern cities the demand exceeds the supply, while, on the other hand, some that consume the least per capita seem to have all the milk that can be used.

In regard to the prices of the various dairy products quoted, it might be said that all the dairymen state that they are receiving 8 cents per quart for all retail milk sold, but there is evidence of considerable cutting from this price. The ice cream sold is evidently not of extra quality, being in all probability made from condensed milk or so-called evaporated cream. Nearly all of the milk sold in Lynchburg is bottled immediately as it comes from the cow and is delivered warm. The milking is done shortly after midnight and early in the afternoon, and two deliveries are made each day.

Lynchburg has no milk inspection, and there is considerable complaint of watered and skimmed milk. Most of the dairies supplying the retail trade are within the city limits, having very small yards for the cattle to run in. The stables are poor affairs, little or no bedding is used, and no effort is made to keep the cows clean. In a wet season and in winter the conditions must be miserable in the extreme. It is just possible that these conditions account partially for the small amount of milk consumed. This city needs to have its milk supply regulated by the health department. This would be the first step in securing good milk. At one time a company shipped milk to Lynchburg from Orange County, Va., but it did not give satisfaction and the company soon failed.

Danville, Va.

Population, 16,520. Amount of milk sold in city daily, exclusive of that produced by family cows, 350 gallons. Number of family cows kept in city not estimated.

The following are the prices for dairy products sold in the city: Milk, retail to consumers, 5 cents a pint, 8½ cents per quart; milk in gallon lots to hotels, restaurants, etc., 20 cents per gallon in summer, 24 cents per gallon in winter; cream containing 20 per cent fat, 40 cents per quart retail; buttermilk, retail to consumers, 10 to 20 cents per gallon.

No milk is shipped into Danville, but some pasteurized cream is shipped from Blacksburg. The dairies that supply the city with milk are all outside of the

city limits, and most of the dairymen attempt to raise a large part of the rough feed given the cows. As the cows have plenty of yard room, and most of them are pastured in the growing season, they are in good condition as regards cleanliness during most of the year. A few of the stables and dairy houses were visited by the writer and appeared to be kept clean. One dairy especially was kept very clean, and it was very evident that it furnished good milk.

The city has recently established milk inspection, and one man devotes the greater part of his time to this work. The milk is required to show 3 per cent fat. Owing to the fact that there are but about fifteen dairies supplying milk to the city, and perhaps as many wagons delivering milk in the city, the one inspector finds it easy to make frequent collections of samples and in this way keep the milk to a very high standard. The city requires that not more than two cows be kept in any one place in the city and this prevents the city dairy. All cows in herds supplying milk to the city are required to be tuberculin tested; but as no animals have responded there may be some question as to the thoroughness of this test. The ordinance states that dairy barns are to be regularly inspected, but as yet no funds have been provided to enforce this part of the work. The cows, as a rule, seem to be very well fed; and the opinion was expressed that in an attempt to improve the quality of the milk many of the dairymen were feeding more grain than they had previous to the inauguration of the inspection service. About half the milk retailed in the city is bottled. A few of the dairymen run the milk over a cooler and aerator before bottling. The rest of the milk is delivered warm, the milking being done in time to allow of the milk reaching the consumer before meals, morning and evening.

There is a great and insistent demand for good milk in Danville, owing to the fact, perhaps, that a few of the citizens have preached the doctrine of pure milk until the consuming public has become educated. In this city the people seem anxious for the establishment of a sanitary dairy and are willing to pledge themselves to its support. There is always a shortage of milk except, perhaps, in June. In the fall and winter there is never enough milk to supply the demands of the people.

Wilmington, N. C.

Population, 20,076. Amount of milk sold in city daily, exclusive of that produced by family cows, 200 gallons. A large number of family cows kept, estimated at more than 400.

The following are the prices for dairy products sold in the city: Milk, retail to consumers, 10 cents per quart; milk in gallon lots to hotels, restaurants, etc., 25 cents per gallon; cream containing 35 per cent fat, 60 cents per quart retail; ice cream of doubtful quality, \$1.50 per gallon; buttermilk, retail to consumers, 20 cents per gallon.

The supply of milk in relation to the demand can be judged from the statement of a hotel proprietor that no difficulty is ever experienced in getting plenty of milk. On the other hand, a large condensed milk trade is reported, many saying that they prefer it to the fresh milk for most domestic purposes. The cream trade is very small. The consumers demand that the buttermilk contain a small number of butter granules as an indication of good faith. This demand is met by churning a little cream at a low temperature so that the butter would come in finely granular form, and adding this to the sour milk.

The retail trade in milk in Wilmington is said to be a growth of the last ten years; prior to that time the city was entirely supplied with milk from family cows. The dairy business is said to be increasing rapidly, and the number of family cows decreasing correspondingly. This city is in a great trucking section

and the land near the city is therefore very valuable. As a result, cows are fed largely on imported feeds, mostly on cotton-seed hulls and cotton-seed meal. There is no city inspection, and because of this fact there is possibly a large proportion of water and skimmilk sold. On the other hand, one of the best dairies in the South supplies milk to the Wilmington market. This dairy keeps about 100 cows. The owner had unusually good knowledge in regard to feeding and how to care for milk, and all the practices common to the so-called sanitary dairy barns were in force in his barns. The cows were kept very clean, the udders were washed, milkers wore clean suits, and the milk was cooled and bottled in a model dairy room.

All of the milk sold in the city is bottled, but much of it is bottled warm. Cows are milked in the morning in time to permit the milk to be delivered for breakfast.

Wilmington is badly in need of a dairy and milk inspection.

Raleigh, N. C.

Population, 13,643. Amount of milk sold in city daily, exclusive of that produced by family cows, 150 gallons. Family cows kept in the city number about 300.

The following are the prices for dairy products sold in the city: Milk, retail to consumers, 7 to 8 cents per quart; milk in gallon lots to hotels, restaurants, etc., 20 to 25 cents per gallon; cream containing 20 per cent of fat, 25 cents per quart retail; 30 per cent fat, 40 cents per quart retail; ice cream of doubtful quality, \$1 to \$2 per gallon; buttermilk, 10 cents per gallon retail.

Though it is evident that very little milk is consumed in the city, it is stated that very little condensed milk is sold. The people, never having been accustomed to the use of milk, do not feel its need. Very little cream is sold, but, on the other hand, there was a good demand for ice cream, though it is doubtful if any ice cream of the best quality is to be had at any price. A peculiarity of the dairy trade is the very low price at which 20 per cent cream sells compared with the retail price for milk, and this, too, when the supply of cream compared with the demand is said to be very short. The demand for buttermilk is also much greater than the supply, though buttermilk sells at a much lower figure than in most cities of the South.

One dairyman in Raleigh has bought all the dairies. The cows, such as he wanted to keep, were moved to a farm 2 miles from the city. The milk was to be cooled and bottled on the farm. The danger where one dairy supplies all the milk for a city the size of Raleigh, and where there are no city regulations to control the quality of the supply, lies in the fact that lack of competition is very likely to lead to poor methods. Raleigh has a great amount of land lying near the city which can be bought at a reasonable price and which could support dairy cows to great advantage. There should be more dairies, and the city should have some control over the quality of the milk delivered.

Greensboro, N. C.

Population, 10,035. Amount of milk sold in city daily, exclusive of that produced by family cows, 200 gallons. Family cows kept in city, estimated at 325.

The following are the prices for dairy products sold in the city: Milk, retail to consumers, 6 to 8 cents per quart; milk in gallon lots to hotels, restaurants, etc., 17 to 20 cents per gallon; cream of poor quality, 25 cents per quart retail; ice cream of poor quality, \$1 per gallon; buttermilk, 10 cents per gallon retail.

Most of the milk retailed in Greensboro is bottled, and it is reported that nearly all of the dairymen have milk coolers. But there seems to be no demand for good milk. The city maintains no milk or dairy inspection, and the health office takes no interest in this work, but the dairy barns seem to be kept in very fair condition. All of the herds supplying milk to the city are outside of the city limits, and are kept on farms where a large part of the rough feed is raised and pasture is provided. There seems to be a demand for more milk than can be procured for the retail trade of the city; but, notwithstanding this fact, one or two dairymen have discontinued a retail business on account of some discouragements, and are getting much less for their milk than could be secured at retail.

Charleston, S. C.

Population, 55,807. Amount of milk sold in city daily, exclusive of that produced by city-kept cows, 300 gallons. Cows kept in the city number about 750, but not all of these are, strictly speaking, family cows.

The following are the prices for dairy products sold in the city: Milk, retail to consumers, 8 to 10 cents per quart; milk in gallon lots to hotels, restaurants, etc., 24 cents per gallon; price of milk paid to producers by retailers, 16 cents per gallon; cream containing 18 per cent of fat, 25 cents per quart retail; ice cream of questionable quality, \$1 to \$2 per gallon; buttermilk, 5 cents per quart retail.

Charleston has two dairies which buy the milk from farms near the city and do a retail business. One of these handles the milk from about 150 cows, most of which are kept on one farm, which is under the supervision of the manager of the city dairy. Two wagons are required for the delivery service. The other dairy handles the milk from 160 cows kept on a number of small farms, and a push-cart business is done exclusively. Both of these dairies bottle a part of the milk, and it is claimed that practically all of the milk is cooled, or at least run over a cooler, when it is milked. It appears that the milk is fairly well cared for in most instances, and consumers unite in the opinion that no skimming or watering is resorted to.

A peculiar condition arises from the fact that Charleston has naturally two sources of milk supply. As has been stated, the milk retailed by the two large dairies is as good as that sold to the greater part of the trade in any Northern city, while the milk sold from the city cows is of very doubtful quality. The retail prices given for milk in the city were 8 and 10 cents per quart. The 8 cents per quart was realized by the dairies furnishing the good milk, while the 10 cents was paid for the milk from the city cows. This is due to two distinct causes. One is the lack of knowledge on the part of the consumers; the other is the fact that most of the city-kept herds are owned by formerly well-to-do residents who have adopted this means of making a living. Thus sentiment operates largely in making the discrimination in prices. What Charleston needs mostly is the education of the consumers to the point where they can realize the advantages of good milk and the menace to the health that is in poor milk and the city dairy herds.

Charleston receives an unusually large proportion of its milk supply from cows kept within the city limits. The health officer claims there are from 500 to 600 such cows, but the manager of one of the dairies before referred to made a count of the cows in the city, and said that there were 850. There are reasons to believe that the manager's count was more nearly accurate than the report of the health officer. These cows are kept in numbers running all the way from 1 to 15. They are found in all parts of the city, the best residence portion not being exempt. The health officer has waged vigorous war against these herds with a view to having them forced out. Up to date he has merely succeeded in

obtaining an ordinance requiring the stables to have board floors and a certain degree of cleanliness as regards the disposal of the manure. In this last matter, however, the health office is having difficulty in securing the enforcement of its demands. The quality of the milk arising from these conditions can not be good, and the menace to the health of the city caused by dairy herds being kept in the center of densely populated districts can not be overdrawn. The health office is certainly justified in its efforts to banish the dairy cow from the city. The health officer reports that so far as he can determine, there has been no decrease in the number of cows kept in the city during the last few years. The people seem to cling to the old system. On the other hand, the dairymen give figures that tend to show that the amount of milk sold from the herds outside of the city is constantly increasing. This no doubt is taking the place of the condensed milk formerly used in the city, a large trade in this commodity being reported. The growth of the dairy industry as related to the production of milk on dairy farms has been a growth of comparatively few years.

Columbia, S. C.

Population, 21,108. Amount of milk sold in city daily, exclusive of that produced by family cows, 250 gallons. No estimate of number of family cows could be secured.

The following are the prices for dairy products sold in the city: Milk, retailed to consumers, 7, 8, and 10 cents per quart; milk in gallon lots to hotels, restaurants, etc., 24 cents per gallon; cream containing 30 per cent fat, 50 cents per quart retail; ice cream made from condensed milk, 40 cents per quart; butter-milk, 10 cents per gallon retail.

About 250 cows, kept in dairies outside of the city, supply the milk sold. One of these dairies has 150 cows and does a good business, everything being kept very clean, and the milk is cooled before bottling. The other dairies each keep a small number of cows, and not much attention is paid to producing good milk; the milk from these dairies is bottled warm. Two deliveries per day are made, the cows being milked soon after midnight and again soon after noon.

It is impossible to make any estimate of the number of family cows kept in the city, as men who should be acquainted with the condition varied in their counts so much as to make their estimates entirely worthless. It is very likely, however, that the usual number of cows common to the cities of the South will be found in Columbia, though there are no herds kept inside of the limits.

There is a demand for more milk than the dairies can supply. Very little cream is sold, and the ice cream was reported to be made mostly from condensed and evaporated milk products, though a very high price is charged. There is no milk inspection.

Spartanburg, S. C.

Population, 11,395. Spartanburg in its dairying is characteristic of many Southern towns of about the same size in that practically all of the milk used in the city comes from family cows. There is but one dairy doing a retail business, and, so far as can be determined, it was leading a very precarious existence. Up to the present summer there were two dairies, one of 12 and the other of 25 cows, but the smaller of the two discontinued business. The larger dairy herd is made up of Jerseys, and the owner supplies pretty good milk. He sells to hotels at 20 cents a gallon, and in quart quantities at 6 cents. Cream for ice

cream is shipped from Biltmore, N. C., and ice cream sells at \$1.50 to \$2.50 per gallon. A small condensed milk trade is reported. No estimate of the number of family cows can be made, but it is evidently not large.

Atlanta, Ga.

Population, 82,872. Amount of milk sold in the city daily, exclusive of that produced by family cows, 5,000 gallons. No estimate of number of family cows can be secured.

The following are the prices of dairy products sold in the city: Milk, retailed to consumers, 7 to 10 cents per quart; milk in gallon lots to hotels, restaurants, etc., 20 cents per gallon; price paid for milk to producers by dealers, 15 to 20 cents per gallon; cream, containing 25 per cent fat, 40 cents per quart retail, \$1 per gallon wholesale; ice cream, \$1.20 to \$3.20 per gallon; buttermilk, 12½ cents a gallon.

Atlanta is supplied with milk from 10 dairies that buy milk from dairy farms and do a retail business, and by about 300 small dairy herds located inside of and near the city limits. In addition to this there is one concern that does strictly a wholesale business, selling to smaller dealers and to hotels. This is run in connection with a dairy farm located near the city, which keeps 200 cows, and in addition to this a considerable amount of milk is bought from dairy farms. The dairies which do a retail business drive from one to three wagons only. Some of the milk which supplies these dairies comes from four farms as far away as 35 miles; but most of it is produced on farms within 10 to 15 miles of the city. Some of the milk from the nearer farms is hauled in by wagons which make the trip twice a day, and some by railway trains, but most of it is carried by an electric road which runs about 15 miles from the city, shipments being made twice a day on both the steam railroad and the electric road.

The unusually large number of dairies inside of the city limits licensed to do a retail business are, as a rule, quite small, running from 2 to 10 cows each. In addition to these small herds is an undeterminable number of cows kept for family use. No estimate as to the actual number of such cows could be made by the health office that had general supervision of the dairy work, but it was said to be large, and very likely ran up well into the hundreds.

Atlanta has a pretty extensive milk inspection that reaches to all farms producing milk for the city. One inspector looks after the quality of the milk sold and one visits the stables and looks after the general sanitary conditions affecting the herds. The city requires that the milk shall contain 3 per cent of fat, and all the dairymen doing a retail business are emphatic in testifying that this regulation is rigidly enforced. The inspector having charge of the city work seems to be particularly active, and samples are taken from the milk of all dairies very often. The health office seemed to be very strict with the milk from herds inside of the city limits, and it is reported that the number of such herds is constantly decreasing owing to the activity of the inspectors. The city regulations require that a certain degree of cleanliness shall be observed in the barns and that all cows furnishing milk for the city trade receive good water. The country inspector reports that practically all milk sent to the city is run over a cooler as it is milked. The greater part of the milk sold in the city is bottled. No preservatives are used, and the milk from the country dairies is about twelve hours old when it reaches the consumers.

A few years ago a large dairy company was organized in Atlanta to handle the retail business of the city. This company for a time handled 2,500 gallons of milk daily and drove about twenty wagons. After being in business for a short time it failed, but was taken up by new men and did business for a few months,

finally falling again, and being entirely abandoned in 1903. The milk dealers of the city think that the failure was due to the inexperience of the men having the business in charge, as the company controlled the business of the city for a short time.

In 1903 the press of Atlanta undertook a crusade against poor milk, and public sentiment was worked up to an unusual degree. This sentiment seemed to have taken a turn toward having all of the milk sold in the city pasteurized. It is very unfortunate for the welfare of the city that this could not have been turned into other channels, such, for instance, as the prohibition of city dairies and city-kept family cows, which are a serious menace to the health of the city, and to a demand that all milk sold in the city be cooled to a reasonable temperature as soon as it was milked.

Savannah, Ga.

Population, 54,244. It is impossible to get any estimate as to the amount of milk sold daily or the number of family cows kept in the city.

The following are the prices for dairy products: Milk, retail to consumer, 7 to 8½ cents per quart; milk in gallon lots to hotels, restaurants, and ice cream makers, 25 cents a gallon.

Accurate information concerning many features of the milk supply of Savannah is most difficult to obtain. No one man seems to know in a general way what is being done in the dairy business outside of his own particular trade. There is no milk or dairy inspection, and the health office has not investigated the milk situation. Some of the doctors of the town have agitated the sanitary side of the question, but the movement is new and the information to be obtained is rather general.

As was stated, Savannah has no milk inspection, and there appears to be plenty of evidence that advantage was taken of this fact to skim, water, and use preservatives in the milk. A large part of the milk for the retail trade is bottled. Most of the dairymen own and claim to use milk coolers, but very little investigation was required to show that the use of coolers is not well understood. In fact, aside from the questionable benefit to be derived from aeration, it is likely, considering the poor care that is taken of the cooler and the dirty surroundings, that the milk would be much better if bottled warm. Two deliveries per day are made, and the milking is done at midnight and noon, allowing the fresh milk to be delivered.

The herds that supply Savannah with milk are mostly kept near the outskirts of the city and within the city limits. A few of the small herds are within thickly populated residence districts, and the family cows are found in numbers in all portions of the city. No pasture is available for any of the city dairies, and, as there is no milk inspection, the barns and yards are kept in poor, even miserable, condition in many cases. Even the dairies which were not in the city limits have so little land that no attempt is made to pasture the cows, cotton-seed hulls and meal being almost the entire dependence for feeds. The land is sandy and feed is not easily grown, and, moreover, the herds are all so near the city that the land which they occupy is too valuable to be used extensively for raising feed and pasturing cows.

There is very little cream trade in Savannah, and the cream used for making ice cream is shipped on ice from Spencerville. The city has plenty of milk, such as it is, and a large surplus is reported for the spring, when most of the cows are fresh, and in summer, when a large part of the milk-consuming population is gone because of the hot weather.

Savannah needs a milk-inspection system very badly. The size of the city,

the climate, and the conditions of the situation of the city make this imperative almost for the welfare of the city. So little dependence can be put on the milk that very few of the infants are fed on this ordinarily best substitute for natural food, condensed milk being preferred by physicians. When the city has a milk inspection it will be time to discuss other improvements which ought to be made. These possible improvements embrace the entire detail of handling milk for a sanitary supply, for at the present time there is nothing to commend in the milk situation as it is found in Savannah.

Augusta, Ga.

Population, 39,441. Milk sold daily, not including that produced by family cows, 600 gallons. Family cows kept in the city, about 500.

The following are the prices for dairy products: Milk, retail to consumers, 6 to 10 cents per quart; cream containing 25 per cent of fat retails at 40 cents per quart, and sells in gallon lots at \$1.20 per gallon; milk in gallon lots to hotels and restaurants, 20 to 30 cents per gallon; ice cream, \$1.50 per gallon; buttermilk, 12 to 15 cents per gallon.

At the time the writer visited the city Augusta had just passed an ordinance for milk and dairy inspection, requiring that the milk contain 3 per cent of butter fat and that certain conditions in reference to the cleanliness of the stables be observed. This had not become operative as yet, and it was impossible to tell what effect it would have on the milk supply. Considering the fact that the city had never had any form of dairy inspection, it was getting exceedingly good milk. Practically all of the dairies furnishing milk for the trade were visited, and, considering that few of the cows were furnished pastures, they were admirably kept, the stables in which the milking was done being clean and the cows in excellent condition. This unusual condition can be accounted for by the fact that there is a very healthy and keen rivalry among the dairymen, each striving to furnish the cleanest and richest milk, a strong element in the situation being the presence of a very fine Jersey herd owned and managed by a man having a good knowledge of sanitary milk.

The greater part of the milk sold in the city is bottled. So far as can be determined, the delivery of this bottled milk when warm is the only serious fault of the milk supply of the city. Two deliveries per day are made, the milking being done at early hours in the morning and afternoon. The herds, with one or two exceptions, are kept on the outskirts of the city, but they are in no instance cramped for yard room for exercise, and they are so far away from the residences as not to be a menace to the health of the city. Practically all of the rough feed is produced on the dairy farms, and green feed is fed largely in summer.

There is a good demand in Augusta for milk, and the dairymen all agree that much more milk could be sold than is now produced. This is particularly true in the winter, when several large winter-resort hotels are open for about four months, and this is a period of the year when the least milk is available. A considerable condensed milk trade is reported.

Macon, Ga.

Population, 23,272. Amount of milk sold daily, not including that produced by family cows, 800 gallons. Number of family cows kept is large, but no estimate secured.

The following are the prices for dairy products: Milk, retail to consumers, 6 to 8 cents per quart; milk in gallon lots to hotels and restaurants, 20 to 25

cents per gallon; cream containing 25 per cent of fat, 40 cents per quart retail; buttermilk, 10 to 15 cents per gallon; ice cream, \$1.25 to \$2 per gallon.

The city limits of Macon are very restricted and have not been extended for many years. It is claimed that a population of about 50,000 live within a radius of 3 miles of the center of the city, and it is very likely that this is near the real population of the city.

Macon has no milk inspection, but milk is furnished from one large herd of Jerseys that comes near in quality to the so-called sanitary milk of Northern cities. Most of the milk sold in the city is first cooled, though it is likely that the cooling in many instances is not well done. Part of the milk is bottled. In summer the milking is done at early hours and the milk delivered twice a day, even though it has been cooled. Macon needs milk inspection.

Jacksonville, Fla.

Population, 28,429. Milk sold in the city, about 500 gallons daily.

The following are the prices for dairy products: Milk, retail to consumers, 8 to 10 cents per quart; in gallon lots to hotels, 25 to 30 cents; ice cream, \$1.50 per gallon.

The source of the milk supply of Jacksonville is different in some respects from that of any other city of the size in the United States. Jacksonville is south of the region where Jersey blood predominates in dairy cattle. One of the dairymen that supply the city has a number of Jersey cows, but nearly all of the other herds are of the small-bodied type of cattle common to the Southern pine lands. This type of cattle is a very light milker, and it is claimed in Jacksonville that the milk is not of very good quality. These cattle are allowed to roam through the woods near the city, and, owing to the climate, they secure green pasture throughout the entire year and are never stabled. There are great areas of unfenced timbered land near enough to the city to afford pasture for all of the cows kept for the city milk trade.

Jacksonville has an ordinance requiring milk to have 3.5 per cent of fat, but the health officer says that it is impossible to enforce this provision of the law because, as he claims, the climate makes it impossible to produce milk with this percentage of fat. The writer has seen nothing in the South that would lead to the belief that the climate affects the fat content of the milk. In fact, all evidence gained from a number of sources goes to show that milk richer in butter fat is produced in the South, as a rule, than in the North. The peculiar type of cow found around Jacksonville and common to all the Southern pine lands may or may not produce milk of average composition. No evidence on this question is obtainable.

Part of the milk sold in the city is bottled and part of it is cooled, but most of the milk is delivered warm twice a day from cans. There is no cream trade, and the cream used for ice cream was said to be shipped from Tennessee. No family cows are kept in the city, owing to the cheapness of pasture so near the city.

Jacksonville needs more rigorous inspection, and the dairymen should be compelled to use coolers. The city has a climate which makes a good milk supply very difficult to obtain, but milk as it is now sold could be greatly improved.

WINTER HOTEL MILK SUPPLY.

In connection with the discussion of Jacksonville's milk supply, it may be of interest to note a report from Jacksonville that the well-known winter-resort hotels located at intervals from St. Augustine for a considerable distance along the Atlantic coast have a peculiar method of securing good milk. This climate

would, of course, be very hard on cows in the summer, and, moreover, there would be no occasion for cows being kept there in summer, as the places are practically depopulated. To meet these conditions, the owner of the hotels owns herds of cows that are shipped into the southern part of Georgia and Alabama for the summer, and a short time before the resorts open are shipped back to the hotels.

Pensacola, Fla.

Population, 17,747. Milk sold daily in the city, 400 gallons.

The following are the prices for dairy products: Milk, retail to consumers, 10 cents per quart; in gallon lots to hotels, 35 cents per gallon; cream with 25 per cent fat, 40 to 50 cents per quart; ice cream, \$2 and up per gallon; buttermilk, 25 cents per gallon. A very heavy trade in condensed milk is reported.

Pensacola is the only city visited where the people are emphatic in stating that not enough milk is to be had to supply their needs. As noted above, prices for dairy products were very high, but poor stock, unfavorable climate, inability to grow paying quantities of feed, etc., all combine to keep the supply much below the demand. It was reported that a Government hospital located near Pensacola was desirous of getting 200 quarts of milk per day, but found it impossible to secure the quantity required. There was very little cream trade in the city, and cream for ice cream was shipped from Tennessee and North Carolina at very high prices.

Pensacola has no milk inspection, and the milk sold is very poor both in composition and from a sanitary standpoint. It is quite evident that much of the milk sold is watered or skimmed. Most of the milk is delivered warm and much of it is not even strained. The demand, coupled with the fact that there is no inspection, makes it possible to dispose of a very poor article of milk.

Not many family cows are kept in the city, though a few of the herds supplying milk to the city were kept inside the corporation limits. An effort is being made to get these herds removed. Very few of the herds had any space for exercise. Practically all of the cattle are fed on imported feeds, owing partially to the poor soil.

The only recommendation that can be offered for the improvement of the supply is that an inspection ordinance be passed, and that it be directed toward securing sanitary milk as well as that having a certain standard of butter fat.

Montgomery, Ala.

Population, 30,346. Milk sold in the city daily, not including product of family cows, 600 gallons; cream, 30 gallons. Family cows kept in the city, between 300 and 400.

The following are the prices for dairy products in the city: Milk, retail to consumers, 6½ cents per quart; in gallon lots to hotels and restaurants, 15 to 20 cents per gallon; cream containing 25 per cent of fat retails at 40 cents per quart; ice cream sells at \$1.25 to \$1.50 per gallon; buttermilk, 10 to 15 cents per gallon.

Montgomery has a very thorough milk inspection and stringent laws governing the sale of dairy products. The milk is required to show 3.5 per cent of fat; and, as samples of milk are taken from every dairy about every week, the dairymen are forced to live up to the requirements of the law very strictly. The writer saw a lot of the samples from different dairies tested, and it was a matter of some surprise to note the relatively high percentage of fat.

The dairy inspection includes the herds, stables, and yards. All cows milked for the city supply are required to be tuberculin tested, and must be furnished

well water or water from a good running stream. Stables are required to be whitewashed and cobwebs swept down; and a number of stables that could not be kept in good condition were condemned. Practically all of the herds supplying milk for the retail trade are kept outside of the city limits with plenty of room. Some have pasture and many receive green feeds in the summer. The number of cows kept in the city is said to be decreasing.

Most of the milk sold in the city is bottled, and part of it is cooled at the time of milking, the rest being delivered warm. Two deliveries per day are made, and the milk is but a few hours old when it reaches the consumer. The city seems to be getting all of the milk required for the demand; some cream was shipped to Pensacola.

Montgomery has a very good milk supply—as good or better than will be found in the greater number of cities of the same size in the North. This is largely due to the activity of the inspector and to the support the law officers give him. The only faults that can be found are with the keeping of family cows in the city and the delivery of warm milk.

Birmingham, Ala.

Population, 38,415. Milk sold in the city daily, not including product of family cows, 900 gallons; cream sold, 50 gallons. Family cows kept in the city, estimated at 500.

The following are the prices paid for milk products in Birmingham: Milk, retail, to consumers, 6 to 10 cents per quart; to hotels, 20 to 25 cents per gallon; paid to producers for milk by dealers, 20 cents per gallon; cream containing 25 per cent of fat sells to consumers at 40 cents per quart; ice cream made from cream containing 20 per cent of fat sells at \$1.50 per gallon; buttermilk sells at 10 cents per gallon. A very large condensed milk trade is reported.

Birmingham has a well-enforced milk and dairy inspection. Milk is required to contain 3 per cent of fat, and the stables and yards where cows are kept are regularly inspected and required to be kept in good condition. All cows furnishing milk to the city are tuberculin-tested. The health officer reports that out of a total of nearly 1,700 cows so tested but 7 responded and were condemned. This appears to be a very low average. As was noted, 500 cows are reputed to be in the city limits, and of this number 60 cows are kept in three dairies, which are the only dairies conducted inside of the city. It was said that a very few years ago fully 2,000 cows were kept in the city, but the number is constantly decreasing, and the dairies which were formerly located in the city have moved out into the country.

Birmingham is in an ideal country for dairying. It is much better adapted to dairying than to any other agricultural pursuit. The land is rough, timbered, and grasses grow well. Good water is abundant. The dairymen seem to be a little more advanced than in most cities, and the city has a well-conducted modern city milk depot, doing a good business. This depot is built according to modern ideas and has every appliance, including a pasteurizing outfit, for handling its milk supply. This dairy has branches in suburbs of the city and, so far as could be determined, it is well patronized. It buys most of its milk from farmers who live as far away as 25 miles. A very strict contract was made with the producers, in which they agree to observe certain conditions in regard to caring for the herd and stables, and in handling the milk. Some cream is shipped from Tennessee. All of the milk sold in Birmingham is said to be cooled as it is milked, and no warm milk is delivered, as is done in practically every other city visited. Most of the milk sold in the city is bottled, but a part is sold from cans.

Mobile, Ala.

Population, 38,469. Amount of milk sold in the city daily, not including product of family cows, 400 gallons. No estimate of number of family cows could be secured, but a large number of families have cows for individual needs.

The following are the prices for dairy products in Mobile: Milk, retail, to consumers, 8 and 10 cents per quart; to hotels and restaurants, 25 to 35 cents per gallon; paid to producers by city dealers, 20 to 22½ cents a gallon; cream sells at 40 to 50 cents per quart; ice cream sells at \$1.50 to \$2 per gallon; butter-milk retails at 25 cents a gallon, and in large lots sells for 20 cents a gallon.

Mobile has no milk and dairy inspection and it is claimed that much of the milk sold in the city is of poor quality, being either skimmed or watered. One milk depot is doing business in the city, the greater part of the milk coming from one farm near the city and some coming by rail as far as 15 miles. Some cream is shipped in from Tennessee. The dairy farm furnishing the greater part of the milk for this depot was conducted along modern lines in every way. It is kept very clean, and the cows are in good condition and have plenty of yard room. Other herds supplying the city are not so well kept. A number of dairy herds are located inside of the city and a few are in the most thickly populated portion.

Most of the milk for the retail trade is bottled and the majority of the dairymen run the milk over coolers as it is milked. Two deliveries per day are made and fresh milk is delivered, requiring very early milking morning and afternoon.

Mobile, like the other seacoast cities, is located in a climate and on a soil that appears to make dairying a difficult occupation. The cows give a light yield of milk, and feed in paying quantities is difficult to produce. On the other hand, it will be noted that prices are inviting. A heavy condensed milk trade is reported; and it was very evident that not enough milk, cream, and butter-milk is obtainable to supply the demand.

Vicksburg, Miss.

Population, 14,834. Milk sold in the city daily, not including the product of family cows, 350 gallons. No estimate of number of family cows kept can be secured.

The following prices are paid for dairy products in Vicksburg: Milk, retail, to consumers, 8 to 10 cents per quart; in gallon lots to hotels, 6 to 8 cents per quart; cream, 90 cents to \$1.20 per gallon. A small condensed-milk trade is reported.

Vicksburg is not one of the cities reporting a large trade in ice cream, and very little buttermilk is sold. The small trade in buttermilk is in striking contrast with the cities visited in the Carolinas and other States south of Virginia. No explanation can be offered, as the climate is the same as in many of the cities mentioned heretofore.

Vicksburg undoubtedly receives milk of very poor quality. Milk is watered and no secret is made of the fact. It seems to be expected by the consumers, and one of the largest producers and retailers in the city, in the presence of his principal customer, told the writer that he added a certain proportion of water to all of his milk, and that every other dairymen doing business in the city did the same thing. A certain standard of adulteration is supposed to be observed. It is stated that all dairymen are supposed to add 1 gallon of water to every 4 gallons of milk. No skimming is supposed to be done, but where a little water is added with the consent of the consumer, there is a strong probability that much more water would be added on occasion. In fact, nothing was seen or

heard that would lead one to believe that the water added to the milk stopped at 1 gallon to 4. It appeared very probable also that skimming is practiced as well as watering.

But watering and skimming milk are not the only faults of the milk supply. All herds supplying the city, with one or two exceptions, are kept inside of the city limits, with inadequate and filthy yard room and exceedingly poor stables. The condition of these herds and stables in wet times can only be imagined, but it must be very bad. None of the milk sold in the city is cooled.

What Vicksburg needs, as a start toward securing better milk, is a few public-spirited citizens with sufficient knowledge of the milk business to start a campaign of education along this line that will open a way for improvement. An inspiration for improvement is within easy reach, as one of the finest Jersey herds in the South is kept near Vicksburg, and the product, which is as well cared for as that from any practical dairy, is sold in Vicksburg.

Meridian, Miss.

Population, 14,060. Milk sold in city daily, not including product of family cows, 250 gallons. Number of family cows kept in the city indefinite, but runs into the hundreds.

The following are the prices for dairy products: Milk retails to consumers at 7½ cents per quart; in gallon lots to hotels, 25 cents per gallon; cream of indefinite quality, 30 to 40 cents per quart; ice cream, \$1.50 per gallon. A large condensed milk trade is reported.

Some ice cream is shipped to Meridian from the northern part of the State. There is a very small cream trade. It is declared by a number of residents, who should know, that there is a plentiful supply of milk to meet all demands, and hotel managers state that they have no trouble in getting all the milk they want.

The health department has had supervision of the milk supply in a limited way for a short time. All dairies supplying milk to the city are required to secure a permit, and this permit makes it possible for the health department to require that certain sanitary conditions be observed in the handling of the milk and the stabling of the cows. The authorities claim that the death rate of infants has decreased materially since these regulations have been enforced.

Part of the milk sold in the city is bottled, and a small portion is cooled as it is milked; but most of the milk is delivered warm, and two deliveries per day are made, the cows being milked very early in the morning and afternoon. Two small dairies are inside the city limits and the remainder are on the outskirts. It is said that in no case is any attempt made to grow a portion of the feed consumed by the cows, cotton-seed products being about all the feed that the cows receive.

Natchez, Miss.

Population, 12,200. Milk sold daily, not including the product of family cows, 300 gallons. A large number of family cows are kept in the city, but no approximate estimate can be secured.

The following are the prices for dairy products in the city: Milk retails to consumers at 8 and 10 cents per quart, mostly 8 cents; to hotels and restaurants, 25 cents per gallon; a small trade in cream at 40 cents per quart; ice cream made from straight milk, \$1.25 per gallon; containing 10 per cent of fat, \$2 per gallon; fancy, \$3 per gallon.

Two of the dairymen supplying milk to the city own good Jersey herds, and, as regards composition, the milk from these two herds is undoubtedly of excellent quality. There is no milk or dairy inspection, however, and a large part of

the milk sold in the city is said to be either skimmed or watered. From a sanitary standpoint, the milk sold in the city might be improved very much. Very little regard is paid to cleanliness in handling the milk, the dairymen seeming to be unacquainted with the first principles of handling milk. Practically all of the milk sold is delivered warm and supposedly fresh. The two Jersey herds are kept in good condition, being well fed and comparatively well cared for. Stables, as a rule, are miserably looked after. No green feed is fed to the cows and very little pasture is available. As in other cities visited by the writer, the cows are fed largely on cotton-seed products. A number of herds are kept in the city limits.

Natchez is badly in need of milk and dairy inspection, and such inspection should put particular emphasis on the handling of the milk and the sanitary condition of stables.

New Orleans, La.

Population, 287,104. Milk consumed in the city daily, 12,970 gallons; cream, 110 gallons.

The following are the prices for milk products: Milk, retail, to consumers, 7½ to 10 cents per quart; in gallon lots to hotels, 20 to 25 cents per gallon; paid by city dairies to rural producers, 10 to 16 cents per gallon, the dealer paying the freight; cream, 30 to 40 cents per quart; ice cream, \$1.50 to \$2 per gallon.

There are a number of features of the milk supply of New Orleans that make it one of the most interesting cities in this regard. The number of dairies within the city limits and the extent of the milk business they do are sufficient to stamp the city as unique. The effect that the milk and dairy inspection laws have had on the quality of the milk is worthy of notice, and there are a number of minor features aside from these that would attract attention.

New Orleans until within the last few years had the reputation of consuming the poorest milk of any city in the country, and, in fact, this reputation still clings to the city in the minds of many people unacquainted with the rapid change that has taken place there in the last few years. Whether the milk supply of the city was bad enough to warrant the repute in which it was held, or whether the bad conditions were magnified, is a matter for conjecture.

New Orleans gets the greater part of its milk from herds inside of the city limits. The last report of the board of health placed the number of such herds at 403, and the number of cows in these herds at 6,723. This did not include 18 herds just outside of the parish of New Orleans, but inside of a thickly populated portion. The greater number of these herds are in one section of the city, and it is likely that fully 4,000 cows are kept within a radius of a quarter of a mile. This close proximity to each other, of course, makes it impossible for the cows to have any pasture or even a large yard for exercise. As is well known, New Orleans is built on exceedingly level land which lies below the high-water mark of the Mississippi River. This makes it impossible to drain the land well during wet periods, and, as the soil is of a nature that works up into mud very easily, the condition of the yards used for the dairy herds must be bad beyond description in certain times of the year.

In comparison with this great number of local dairies, only 46 dairies outside of the city send milk by rail to New Orleans. Most of these dairies were formerly located in the city, but owing to difficult conditions moved out to a place called Hammond, about 40 miles from the city. Though they got away from the city, they did not get away from the old way of keeping cows; and, instead of taking the opportunity to raise a large part of the feed and reduce

expenses, they conduct the business the same way that the great majority of dairymen supplying milk to Southern cities would. They bought small lots of land, which were entirely insufficient to use for pastures, and so fed their cattle on purchased feeds. All this in a country where land was cheap, easily cultivated, and where a little manure added to the soil would grow green ~~forage~~ crops in quantities that would astonish Northern farmers. Instead of being a benefit to the milk supply, as it should have been, this movement into the country simply took the dairies that moved to Hammond out of the strict supervision of the board of health. It led to a few things, however, that were an improvement over former methods of handling the milk. The facts that the milk had to be shipped quite a distance and was several hours old before reaching the consumer, and that the inspectors make no allowance for an unfavorable climate and absolutely prohibit preservatives, have led to very careful treatment of the milk on the part of the producers. It necessarily has to be cooled to a low temperature where it is milked, and all utensils must be kept clean. These are two conditions which are not observed by the dairymen keeping herds in the city and suburbs.

As is mentioned above, the dairies and the milk are under very strict supervision by the board of health, the ordinances regulating the milk supply are comprehensive, and the dairymen bear witness by an unusual amount of complaining that these ordinances were rigidly enforced. The ordinances affecting the milk supply cover the following points: Milk must contain 3.5 per cent of fat and no preservatives; barns must be well ventilated, have 600 cubic feet of space for each cow, be whitewashed, and have water-tight floors. Barns, yards, and cows must be kept clean. Cans and bottles must be well washed, and bottles must not be refilled from cans in the wagons. All cows are tuberculin-tested. A good water supply must be insisted upon; and no distillery slops are allowed to be fed to cows. So far as could be observed these provisions are enforced by the inspectors. All stables are whitewashed and kept cleaner than similar stables furnishing milk to any other city in the country. There is one serious condition that the board of health has failed to remedy and can not improve, and that is the filthy yards attached to the stables. As was stated, this soil has a great tendency to work up into deep mud in wet spells, and the only possible way that this can be avoided is to provide sufficient space to allow the land to keep a good sod. This means that the cows must be pastured, and for this they will need to be removed outside of the city limits. An ordinance has already been passed which provides that all of these herds must be outside of the city by 1908. This is commendable in so far as the presence of these herds with attending filth is a menace to the health of the city; but if these herds simply remove to towns within shipping distance of New Orleans and, as is the case of the dairymen who have removed to Hammond, conduct their dairies on the same plan as is now being done in that city, it is difficult to understand how it will benefit the milk sold in the city. With the exception of one or two faults, which could be easily remedied, New Orleans is getting comparatively good milk at the present time. The milk and dairy inspectors have evidently worked wonders with the quality of the milk. It is not difficult to imagine what kind of milk was sold when no restraint was placed on the dairymen.

Most of the milk sold in New Orleans is delivered warm, fresh from the cow, but the milk and cream shipped in by rail is cold when delivered. Part of the milk is bottled, but most of it is sold from cans. These cans, holding from 10 to 15 gallons each, are carried in pairs in a type of milk cart peculiar to this city. It is a very high cart, carried on two wheels, and the cans are placed on a seat or shelf in front of the driver's seat. This vehicle was evi-

dently designed for a trade that required that the housekeeper should come to the street for the milk instead of the driver going to the door. For modern delivery of milk it would be hard to imagine a more awkwardly constructed delivery wagon than these two-wheeled carts.

There is a particularly good dairy located in a parish adjoining New Orleans. This is a sanitary dairy in the strictest sense of the word. The cows are properly fed and cared for, the stables are cleaned, and the milk is handled with all the care possible. It is very doubtful if any other money-making dairy in the country furnishes better milk than does this one. Though a higher price is charged for the milk produced in this dairy than any other dairy in the city, it is said that only a small part of the demand can be supplied. At the time of the visit of the writer there was a movement on foot to form a stock company to enlarge the herd and the amount of milk handled. If all the milk consumed in every city in the country was produced under such cleanly and healthy conditions and handled with the same regard for sweetness and purity, there would be no problems of city milk supply to be solved.

About the only suggestion that can be offered for the improvement of the milk sold in New Orleans is that the producers be required to cool the milk when it is milked. Such a regulation should not be difficult of enforcement. The board of health has undertaken and accomplished much more difficult tasks than this with regard to the dairies.

Baton Rouge, La.

Population, 11,269. Amount of milk sold in city daily, not including product of family cows, 150 gallons. A large number of family cows are kept in the city, but no estimate as to the number can be secured.

Milk retails at 25 to 35 cents per gallon retail and 25 cents per gallon to hotels. Cream sells for 40 cents per quart. There is not much ice cream trade and no buttermilk trade. The little cream sold is shipped in and is handled by grocery stores.

No bottled milk is sold, and practically all of the milk is delivered warm immediately after milking. Two of the dairy herds supplying milk for the retail trade are kept inside of the city. The others are in the country. With one or two exceptions, the herds in the country are confined in small yards, and have no pasture or green food of any kind. Cotton-seed products furnish practically all of the feed. The land around Baton Rouge is well drained and this prevents the yards from becoming so filthy as they might otherwise become; but there is no attempt on the part of the owners to keep the yards in good condition. The stables are very poor affairs, consisting principally of walls and a roof; no floors are provided.

One very interesting thing noted in connection with the dairy industry as it appears in this particular section is the fact that the dairymen allow the calf to suck the cow before milking in order to get the milk flow started. This requires that the calf of every cow be kept so long as the cow gives milk. As these calves are kept in very small, filthy pens, and are about half starved, they are not an attractive feature. Cows, as a rule, seem to be well fed and in good flesh. The labor conditions are very bad and consequently all of the work is done by the owner and his family. There seems to be a good demand for milk.

The city has no regulations governing the sale of milk or the care of dairies. Baton Rouge needs a milk and dairy inspection law, and until this is provided and enforced there is nothing that could be suggested that would improve conditions.

Memphis, Tenn.

Population, 102,320. Milk sold in city daily, 8,500 gallons; cream, 100 gallons daily.

The following are the prices for dairy products in Memphis: Milk, retail to consumers, 25 to 40 cents per gallon; cream, containing 30 per cent butter fat, 25 cents per quart; milk in gallon lots to hotels, 11 to 20 cents per gallon; ice cream, 80 cents to \$1 per gallon; paid to producers for milk, 11 to 15 cents per gallon, plus freight; for cream, 30 cents per pound for contained butter fat, plus freight; buttermilk and skim milk in large lots, 10 cents per gallon.

Most of the milk consumed in Memphis is produced on the outskirts of the city, though a little is shipped in by rail from a short distance. Nearly all of the cream used is shipped from Arkansas, a distance of 20 to 50 miles. A number—perhaps the majority—of the dairies in and around Memphis are what would be called city dairies, having only a small lot in which to keep the cows and no facilities whatever for raising any of the feed consumed by the cows. A few only of the dairies located outside the city raise practically all of the green feed necessary by a system of intensive farming. These dairies have learned how to handle milk as well as how to grow feed, and some of them would take rank almost as sanitary dairies. They have good milk rooms built separately from the stables, and the milk is drawn under very cleanly conditions and is cooled and bottled as soon as milked. At least one dairy had a pasteurizer, and subjected all the milk sold to this process. Milk from this dairy sold at 10 cents per quart, and it can be said to the credit of the consumers that it was impossible to meet the demand.

A very strict milk and dairy inspection law is rigidly enforced in Memphis. Milk is required to show 3.5 per cent of fat, and, according to the analyses submitted to the writer, the greater part of the milk contains above 4 per cent of butter fat, and a good portion runs better than 5 per cent. In fact, it appears that unusually rich milk is produced around Memphis, and the board of health insures rich milk for the consumer. The office in charge of the inspection inaugurated a practice of going directly to the herds and securing a sample of the fresh milk for comparison with the samples taken on the street whenever there was suspicion that all was not right. These comparative samples show highly interesting results, and the practice seems to have done much toward influencing public opinion and securing convictions. Inspectors visit herds and stables regularly. Stables are required to be whitewashed, and yards must have the manure scraped out during the wet season so as not to become filthy. The inspection has brought about a very good condition of affairs in this respect, except that the stables, as a rule, have very poor floors. Cows are well fed and appear to be perfectly healthy.

A part of the milk sold in the city is bottled and a part is cooled before it is delivered; but too much warm fresh milk is sold. Some of the dairymen make a pretense of cooling the milk by setting it in tubs of water, but, as the water is not very cool even when fresh, this is very ineffective. In fact, it is doubtful, considering all things, if it aids in the least in insuring good milk to consumers.

Few improvements can be suggested for the betterment of the milk. As stated above, there is too much warm milk delivered in the city. This could be easily remedied. Setting milk in a tub of water, unless it be ice water, is of doubtful benefit. The use of a mechanical cooler should be enforced. Dairymen should be required to have good floors in stables. This is fully as necessary as having stables whitewashed.

Chattanooga, Tenn.

Population, 30,154. Milk sold daily in city, 2,000 gallons. A large number of family cows.

The following are the prices for dairy products: Milk, retail to consumers, 24 to 30 cents per gallon; cream, containing 20 per cent butter fat, 25 cents per quart; milk to hotels in gallon lots, 16 to 20 cents a gallon; ice cream, 40 cents a quart, \$1.25 a gallon; paid to farmers for milk, 15 cents per gallon.

Some of the milk consumed in Chattanooga is shipped as far as 60 miles, but the greater part is produced in the city or within a few miles of it. Several large dairies are within the city limits, and a number of herds are kept on farms where all of the green feed consumed is raised. There is no milk or dairy inspection, and stables and yards located in the city are in very bad condition.

Part of the milk sold in the city is bottled. A pasteurizing plant installed six years ago handles a large part of the milk sold in the city, and appears to be doing as good a business as the character of the milk sent by producers will permit.

Chattanooga is in need of inspection. In the absence of inspection it is impossible to suggest any improvements in the city milk supply. The city is situated in a place that should warrant the purest milk, as it does good water. It is a pity that the city should content itself with poor milk when it would be so easy to get good milk.

Knoxville, Tenn.

Population, 32,637. Milk consumed daily, excluding product of family cows, 1,000 gallons. No estimate of the number of family cows obtained.

The following are the prices for dairy products: Milk, retail to consumers, 6 to 8 cents per quart; to hotels and restaurants, 20 to 25 cents per gallon; cream, 30 cents per quart; ice cream, \$1 to \$1.25 per gallon.

Some milk is shipped a distance of 20 miles by rail into Knoxville, but the greater part of the milk is produced near the city. Knoxville is in an ideal country for dairying, but there is no particular evidence that the city milk supply is benefited by this fact. A couple of good dairies supply a small portion of the milk consumed. One of these is the State experiment station dairy. An expert is in charge of this dairy, and all modern appliances are used in caring for the milk. This milk goes to supply the better class of trade in the city. There is no milk or dairy inspection, and the majority of dairies take advantage of this fact to supply skimmed and watered milk. A small portion of the milk sold in the city is bottled and some is cooled, but the greater part of the trade is warm milk sold from cans. There is very little cream trade.

Knoxville is badly in need of an inspection ordinance that will cover both the source and the selling. The stables are very poor and are filthily kept. The milk receives no treatment whatever.

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